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Mindfulness and Testing: An exploration of the benefits of mindfulness based cognitive
meditation practice on test anxiety

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Abstract

Test anxiety is a growing concern for students as it can negatively impact student performance. Mindfulness is a practice of focused breathing meditation intended to increase awareness of oneself and the present moment and decrease anxiety. With the recent increase in mindfulness practices in schools, this research examines the potential impact of mindfulness-based cognitive practice on anxiety levels, test anxiety, and standardized test scores through the use of the ACT standardized placement test, the TAI-G, a self-administered Test Anxiety Inventory, and the Biodot, a device measuring physiological indications of anxiety. Using analysis of variance and paired samples t-tests, a significant reduction in anxiety levels after mindfulness exercises were identified; however, no differences in standardized test scores or self-reported anxiety emerged. The significant impact of mindfulness on anxiety levels during individual sessions and the potential for significance over time merit further research.

Keywords: test anxiety, mindfulness based cognitive practice, mindfulness practice in schools, meditation, standardized test scores, Biodot

Dedication

Many thanks to my committee chair, Dr. Grant Smith for working through mindfulness on my behalf, Dr. Mary Ann Cahill for encouraging me with links to new mindful practices, and Dr. Amy Lein for the editing help and her willingness to step in. Thank you to Dr. Amy Saltzman for sharing her knowledge and guided practice with me free of charge and to Rhett Butler and the Torch Prep team for sticking with me for two years, allowing me to use their practice tests, and scoring them as we worked together to improve ACT test situations for students across the nation. Thank you to Dr. Mowbry for allowing me to utilize the TAI-G and providing the scoring rubric. Most importantly, I give thanks to Marty, my devoted spouse, and my supportive, sweet children (Brenden, Mary, Zax, and Liam) and my extended family for putting up with mindfulness mixed with insanity for the last four years. Lastly, to my coworkers and our students for their support and for allowing me to bring new ideas and the practice of mindfulness to our school in the first place.

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Introduction

Background

As the principal in a private, all male high school, I administer the American College Testing test (ACT) to our students every year. It never fails that students come out of the test making remarks about their nerves, not remembering anything they studied, or being unable to focus. I often wonder how we can help students to prepare for this and other standardized tests aside from practicing and teaching academic strategies for test-taking. I was introduced to the practice of mindfulness in August of 2016 and was immediately interested. Mindfulness is operationally defined as “the awareness that emerges through paying attention on purpose, in the present moment, and nonjudgmentally to the unfolding of experience moment by moment” (Kabat-Zinn, 2003, p. 145). Mindfulness practice has many forms, but through this nonjudgmental awareness comes an acceptance of the person, the present moment, and the environment as it is. It allows for more focused attention to tasks and can decrease stress levels significantly (Baer, 2003; Keng, Smoski, & Robins, 2011). I began to read books and articles about the effects of mindfulness on students in the classroom and invited Dr. Shelly Sowell (2014), a counselor and educator in the practice of mindfulness, to our high school to provide insights to our teachers and administrators about the practice of mindfulness and how to include it both in their personal lives and in the classroom. Dr. Sowell led us through a brief mindfulness practice and instructed the teachers on how to do this for five minutes a day in their classes, indicating that it can have a positive impact on the classroom environment.

Kabat-Zinn (1994) is a pioneer in teaching mindfulness (also known as meditation) to the average person for the sake of being aware and attentive to the here and now as these are often forgotten in our current society. Because the administration in my school wanted our students to

be present, attentive, and aware, we began to introduce mindfulness to our students during a set time once every other month. The response was immediately positive, although anecdotal. The students left feeling rejuvenated, the teachers remarked that student attention levels and engagement improved, and students wanted to do it more often. I began to wonder what other positive effects could come from practicing mindfulness with adolescents and what the impact of those effects would be on academic performance. A controlled trial by Huppert and Johnson (2010) reported reduced anxiety and acceptance of experiences among male high school students exposed to a mindfulness intervention. In a pilot trial of an integrated mindfulness curriculum for adolescents, Broderick and Metz (2009) found that participants “reported reductions in negative affect and increases in feelings of calmness, relaxation and self-acceptance compared to controls” (p. 41).

Problem

Test anxiety interferes with thoughts and emotions and increases off-task behavior (Cassady & Johnson, 2002; von der Embse, Barterian, & Segool, 2013; Zeidner, 1998), such that students focus their energy and capacity for finding solutions on the issue of anxiety rather than the cognitive task at hand and struggle to suppress competing thoughts. These thoughts include worrying about grades, comparing self to others, and/or dwelling on the thought that he/she did not prepare well enough for the exam (Cassady & Johnson, 2002; Coy, O'Brien, Tabaczynski, Northern, & Carels, 2011; Sarason, 1984; Zeidner, 1998).

Early studies with adults practicing mindfulness revealed a benefit in social and emotional well-being and researchers began piloting mindfulness based interventions (MBI) with youth in the early twenty first century (Renshaw & Cook, 2017). While these early studies examined the impact of mindfulness, they did not examine how much or how little practice is

necessary to be beneficial (Renshaw & Cook, 2017); however, we do know that the skills for meditation and mindfulness do not come naturally and must be practiced in order to attain beneficial levels of self-examination and appreciation for the moment at hand (Kabat-Zinn, 1994, 2003; Parsons, Crane, Parsons, Fjorback, & Kuyken, 2017). Research in schools has continued to grow due to the positive effects of MBI on student academic achievement and overall functioning. Renshaw and Cook (2017) noted that teachers have struggled to keep adolescents attentive and focused due to the onslaught of technology, hormones, instant gratification and access to information and social media. Simultaneously, the occurrence of depression and behavioral disorders has heightened. There is a need for intervention beyond medication to keep students focused, calm, and able to use the available tools to handle any given situation (Saltzman, 2014).

According to Jha, Krompinger, and Baime (2007), “attention is central to many higher order cognitive operations...as such, the ability to improve attention with training methods has the potential to be beneficial in many domains” (p. 117). When attention is disrupted by negative cognitive thoughts, it has the debilitating effect of poor test performance (Ikeda, Iwanaga, & Seiwa, 1996; Kurosawa & Harackiewicz, 1995; Sarason, 1984). Sarason (1984) notes that “worry over evaluation leads to task-irrelevant cognitions that interfere with attention to the range of cues in the situation. The wider the range of relevant cues, the greater the debilitating effects of cognitive interference” (p. 936). According to Kurosawa and Harackiewicz (1995), cognitive interference occurs when negative self-talk interrupts task performance by diverting attention away from the task at hand and relevant thoughts which cause a disruption in task performance. Coupled with the inescapability of assessment and evaluation in schools across the United States, the impact of test anxiety on test performance deserves a

closer look as do interventions which may counter the adverse effects of anxiety (von der Embse et al., 2013). These interventions have included various cognitive behavioral methods including anxiety reduction and meditation. In their systematic review of 10 treatment studies, von der Embse et al. (2013) found that students in both elementary and secondary settings who were exposed to relaxation methods reported less anxiety, with two specific studies suggesting that there were “positive treatment outcomes across universal prevention programs teaching students relaxation techniques” (p. 67). They also found that multiple studies confirmed that students with high test anxiety did not perform as well on examinations. In reviewing the evidence of the frequency of test anxiety, McDonald (2001) found that fears associated with assessment appear to be widespread and increasing with a detrimental effect on performance, which could mean the difference between passing and failing a course or getting into college. In his seminal work on test anxiety, Zeidner (1998) indicates that tests have become an integral part of our society and can determine placement or advancement in schools, military, careers, and industries. Students who have the ability to do well often fail to do so due to test anxiety which in turn limits their ability to gain entrance or acceptance into programs or schools.

Test anxiety has become a phenomenon of educational study due to its impact on test performance (Putwain, 2008) as well as its more dire effects, including thoughts of suicide in adolescents (Keogh & French, 2001). The negative effects of test anxiety range from mental factors such as reduced motivation and fear of failure to physiological factors such as tension, sweaty palms, and increased heart rate to severe cognitive disruption and distractibility caused by worry (Keogh & French, 2001; Lowe et al., 2008; Yeo, Goh, & Liem, 2016; Zeidner, 1998). This anxiety comes not only from the individual’s personal ideas of himself, but also by our

achievement oriented society and the social-evaluative nature of a situation such that one is judged based on one's test score (Zeidner, 1998).

A study by Yeo et al. (2016) involved a school-based intervention that “provided preliminary evidence on the utility of brief, school-based anxiety interventions in test anxiety prevention for children” (p. 1). This quasi experiment divided fourth grade students into two groups: a cognitive behavioral therapy (CBT) group and a control group. The CBT group was taught both meditation (behavioral) and coping strategies to regulate feelings and behaviors (cognitive). The CBT group received intervention for 30 minutes four times across four weeks. A 3 x 3 mixed design ANOVA was used to analyze the treatment in relation to academic levels at various times (pre, post, and 2 months after treatment). Effects of the intervention included significantly lower test anxiety levels in the CBT group at the follow up as compared to no change in the control group ($M = -0.01$, $SD = .41$, $t(113) = -2.74$, $p = .007$, two tailed). Their results also indicated that average-achieving students with high test anxiety benefited most from this type of treatment.

If there is a method that can be used in schools to combat test anxiety and thus ensure the accuracy of test results, which often measure the student, teacher or school accountability levels, then it is worth the investment in research (Sarason, 1984; von der Embse et al., 2013). Timed tests can cause larger problems for those with high test anxiety because the negative self-talk and worry interfere with cognitive ability and perception of how time is passing and simultaneously cause delays in one's ability to assess problems in a timely manner (Ikeda et al., 1996; Sarason & Stoops, 1978).

Purpose

The process of mindfulness is a tool that can help decrease test anxiety (Yeo et al., 2016). The present study examined the impact of mindfulness-based cognitive training as a means to increase focus and cognitive functioning while decreasing test anxiety as well as the impact of mindfulness-based cognitive training on test performance. According to Huppert and Johnson (2010), “staying consciously aware of what is happening allows us to see and experience things as they really are and have choice over how we respond” (p. 265). In a study by Smalley et al. (2009), results indicated a lack of mindfulness in students with ADHD and suggested that mindfulness training might boost attention skills in these students. There exists a need for further research in order to understand how best to utilize mindfulness in schools and what the impact might be on standardized tests and academics (Lawlor, 2014; Renshaw & Cook, 2017). If mindfulness not only increases engagement, decreases problem behaviors, and increases social and emotional well-being in adolescents, but also reduces anxiety and increases focus when testing, then it becomes evident that mindfulness is a worthy practice in schools (Chiesa, Calati, & Serretti, 2011; Eklund, O'malley, & Meyer, 2017; Kuyken et al., 2013; Lawlor, 2014; McDonald, 2001; Rothman, 2004; Simpson, 2017). Studies have found that mindfulness training improves one's working memory capacity and that those who meditated were able to “disengage more quickly from incorrectly cued visual information and more flexibly re-directed attention to new information” (Chiesa et al., 2011, p. 459). Chiesa et al. (2011) also found that those who meditated could maintain focus at significantly higher levels than those who did not. Those who practiced mindfulness not only maintained focus, but also had increased executive functioning “including verbal fluency and inhibition of cognitive responses, as well as...meta-awareness and emotional interference from distracting stimuli” (p. 461). These skills are beneficial in academics and could aid students in classroom performance as well as on standardized tests.

At this point, schools do not regularly teach strategies to control test anxiety and the increased use of standardized tests and exams in the school systems to determine a student's future possibilities is causing an increase in the pressure of success and achievement in these situations (von der Embse et al., 2013). Test anxiety can be debilitating among school aged children and often there is no intervention offered due to a lack of time and resources (Yeo et al., 2016). However, if an effective treatment is found that could be implemented in schools, then it would be worth researching and would give school psychologists "a unique opportunity to help test-anxious students manage their anxiety and increase their academic performance" (von der Embse et al., 2013, p. 69).

Research Questions

Does the practice of a mindfulness-based intervention that addresses both physical relaxation (emotionality) as well as cognitive restructuring (worry) reduce a student's test anxiety (worry and emotionality)? Does this same practice improve a student's performance on the American College Testing test (ACT)?

Assumptions

It is assumed that the students taking the ACT understand the importance of their performance on the ACT and thus may have some anxiety about taking the test. It is also assumed that they have completed the bulk of necessary coursework (2 years of high school math, English, and science) to be prepared for the ACT. To control for this, the importance of the test and the benchmarks students must achieve to be pronounced college ready will be explained prior to testing as part of the treatment and control. Since 98% of the students in the schools where this research is taking place plan to attend college (based on secondary school reports), it is assumed that they have an idea of the impact of the ACT score on their future

plans. It is also assumed that the participating students have had no formal training in mindfulness prior to participating in this study, and to control for this, I gathered data using a survey given out during the pre and post-tests to check assumptions (see Appendix A).

Implementation of mindfulness training was done with fidelity through the use of a recorded session played to each group during each session and students attended to mindfulness with a prescribed regularity (Lawlor, 2014). The mindfulness training addressed a student's abilities to concentrate, the fear and pressures of standardized testing, anxiety, and social and emotional well-being (Zalaznick, 2017).

Key Terms

Mindfulness

Mindfulness may be thought of as a state of mind, but there is a difference between trait mindfulness, that which is one's personality, and practiced mindfulness, a state of being aware (Garland, Gaylord, & Park, 2009; Weinstein, Brown, & Ryan, 2009). According to Lutz, Slagter, Dunne, and Davidson (2008) there are two styles of meditation: focused attention and open monitoring. Mindfulness is the application of focused attention. Focused attention involves sustained awareness and focus on an object such as breath sensation and that which is occurring within you and around you in that moment. It allows the mind to drift while being aware that it is happening and bringing the attention back to the object such that one allows those thoughts to come and affirms that they exist while pushing them aside to refocus on the object or task at hand. (Lutz et al., 2008; Renshaw & Cook, 2017). Focus and attention are often used interchangeably in this research paper as they are used as such throughout the reviewed literature. For this research, students will be practicing focused attention mindfulness through an in-person group instructor using the same recording each session.

American College Testing (ACT)

The ACT® is a nationally normed standardized test utilized in the United States during a student's junior or senior year of high school to determine their college academic readiness (ACT.org, 2017). The test includes 215 multiple-choice questions (75 English, 60 mathematics, 40 reading, and 40 science) and takes approximately three hours. Raw scores from each subtest are converted to scale scores, which range from 1-36. The four subtest scores are averaged resulting in a composite score for the individual. Benchmarks have been set to determine college readiness and if they are not achieved, students may or may not be accepted into college or may have to take remedial coursework prior to taking college credit classes. The benchmarks are as follows: English (18), Math (22), Reading (22), and Science (23).

Test Anxiety

Test Anxiety is defined by both cognitive and physiological constructs with two primary factors: worry, which presents itself as negative self-talk or cognitive concern about performance and emotionality, which includes involuntary, autonomic reactions to the test situation (Hembree, 1988; McDonald, 2001; Yeo et al., 2016). Physiologically, a person with test anxiety might have sweaty or clammy palms, increased heart rate, and tension in his/her body as well as physical illness. According to a study by Vinkers et al. (2013), the temperature of the human body as measured at the base of the finger decreases at a statistically significant rate when exposed to stress $F(30,600) = 1.69, p < .001$. Cognitively, it is the disruption of thoughts, interference in processing, and distraction caused by worry and social failure or humiliation (Lowe et al., 2008; McDonald, 2001; von der Embse et al., 2013; Zeidner, 1998). Test anxious individuals focus on negative thoughts about themselves and their abilities and competencies, and have a preoccupation on failure and self-doubt during examination circumstances (Zeidner,

1998). Test anxiety is rooted and shaped by “a unique configuration of constitutional, familial, social, educational, and experiential factors” (Zeidner, 1998, p. 168) which interact in unique ways to determine how test anxiety is manifested in an individual.

Test Anxiety Measurements

The German Version Test Anxiety Inventory (TAI-G) is a research based 17-question inventory measuring the cognitive facets of test anxiety in four factor areas including worry, emotionality, distraction or interference, and lack of confidence. It was originally developed as a two-dimensional, 30-item inventory by Hodapp and Benson (1997) and later refined into a four-dimensional, 17-item version called the TAI (Ringeisen, Buchwald, & Hodapp, 2010). This self-report inventory measures four factors including worry and emotionality by using a 4-point Likert scale ranging from 1 (almost never) to 4 (almost always) and includes questions pertaining to thoughts and feelings during exam situations, such as ‘I think I will succeed’ and ‘I worry about the test I will be taking’ (see appendix B). The 17-question version has been compared to other revised versions and research has confirmed the structural validity of the TAI-G 17-item model in measuring test anxiety levels with a fit superior to the other models for all factors and a reliability coefficient greater than .70 at $p < .01$ (Mowbray, Jacobs, & Boyle, 2015).

The Biodot® is a small sticker, placed on the back of the hand in the webbing between the thumb and forefinger, which measures skin temperature by the amount of blood flow through the skin; the more relaxed a person is, the more blood flow they have, the warmer the skin (Looker, 1985; Schultz & Schultz, 2014). Unpublished studies have used the biodot to assess skin temperature as a means for determining stress levels. These studies examined stress levels during testing and performance situations and oral presentations (Schultz & Schultz, 2014). According to Schultz and Schultz (2014) the information gathered validates the use and

credibility of the Biodot as a biofeedback device. In an email exchange with Schultz (2020), he shared that the reliability coefficient for the Biodot was 0.81, but it was calculated as part of proprietary research work that is not available to the public. Figure 1.1 shows how the sticker works.

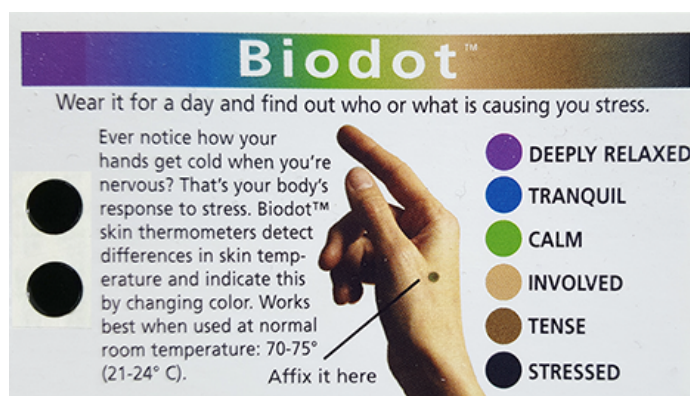


Figure 3.1 Biodot measurement scale. Each color was assigned a value (black=6, brown=5, amber=4, green=3, blue=2, violet=1; colors in between were given an additional .5). Picture obtained from StressStop.com from which the Biodots were ordered.

Biodots were used to measure perceived stress in a study by Balk, Chung, Beigi, and Brooks (2009). They utilized the Biodot before and after a relaxation training intended to decrease stress levels. Before the training the participants were coded as mainly black with a median skin temperature of 87°F, and the median temperature after the relaxation training was coded as green indicating a body temperature 91.6 °F, which was an increase of 4.6 °.

Literature Review

Test Anxiety Construct

Test anxiety as a construct was first introduced in the 1950s by Yale University faculty who grouped students into high and low test anxious categories and for the first time recognized that students with high test anxiety performed significantly worse than those with low test anxiety (Hembree, 1988). Research has increased since the 1950's and reached a peak in the

1980's as the importance of exams such as the MAT (Mathematical Aptitude Test) and SAT (Scholastic Aptitude Test) became the leading determinants of college acceptance (Hembree, 1988; Sarason & Mandler, 1952; Zeidner, 1998). Theories such as the Cognitive Interference Theory (CIT), first developed by Sarason (1984), became widely used in the study of test anxiety and is still used today (Cassady & Johnson, 2002; Coy et al., 2011; Culler & Holahan, 1980; Sapp, 2014; Sarason, 1984; Yeo et al., 2016). In his seminal work, Zeidner (1998) reviews the test anxiety construct, test measurements, and research claiming that as long as our country continues to be centered on performance and ability as a means for measuring success, there will be a continued need to research test anxiety and find ways to minimize the impact on test performance. Test anxiety manifests itself in phenomenological, physiological, and behavioral ways when exposed to a testing situation (Keogh & French, 2001; Sapp, 2014).

Cognitive interference plays a major role in understanding how test anxiety can lead to poor test performance due in part to one's inability to suppress competing thoughts during a testing situation (Cassady & Johnson, 2002; Sarason, 1984; Zeidner, 1998). The Cognitive Interference Theory "assumes that...anxiety during tests interferes with the student's ability to retrieve and use information that is known well" (Culler & Holahan, 1980, p. 16). These thoughts are involuntary and impede on people's ability to give the task at hand their complete attention. This cognitive interference has been shown to have a significant impact on lowering test performance and the largest amount of cognitive interference came from subjects with the highest levels of test anxiety (Sarason, 1984).

The Cognitive Interference theoretical model is based on two major components of test anxiety namely worry and emotionality. Worry refers to the cognitive aspect of test anxiety and includes preoccupations, self-doubt, irrelevant and negative thoughts of failure, disappointment,

and other insecurities. The worry component causes an interruption of thought processing by disrupting memory function, interfering with cognitive processes including focus, memory, and information retrieval and thus negatively impacts test performance (Hembree, 1988; Tryon, 1980; Zeidner, 1998). Emotionality refers to an awareness of bodily arousals and tensions manifested in physical ways such as increased heart rate, sweating or cold clammy hands, physical sickness, faster breathing and other physiological responses (Hembree, 1988; Kurosawa & Harackiewicz, 1995; Sarason, 1984; Zeidner, 1998). Although worry and emotionality are two separate components of test anxiety, they do tend to co-occur in individuals who score highly on the test anxiety inventory (.82 for males, .83 for females); however, treating one component does not necessarily change the other for the test anxious individual. Rather, both worry and emotionality must both be treated as it is the combination of the two that causes the greatest impact (Hembree, 1988; Sarason, 1984; Tryon, 1980).

The level of test anxiety overall (both worry and emotionality) may depend on task-related variables including the perceived difficulty of the test, instructions given, the layout of the test, the order of the test, the instructor, or the atmosphere (Keogh & French, 2001; Sapp, 2014; Zeidner, 1998). A test anxious individual enters a testing situation as a perceived threat. The threat causes negative, self-defeating thoughts, and uncontrolled emotions along with physiological changes. Zohar (1998) describes this phenomenon using an appraisal theory in which the specific exam situation determines the intensity of emotion based on how threatening the exam is. The range of emotions felt is multi-dimensional and can include fear, anger, and loneliness. The intensity and range of these emotions depends upon both personal disposition and situational factors influencing the appraisal. A non-test anxious individual has fewer worrisome thoughts, perceives the test as non-threatening, and does not battle negative thoughts

or bodily reactions (Sapp, 2014). Test anxiety may manifest itself as follows: students study, understand, and are fully prepared for a test, but as soon as they enter into the testing situation they panic and some questions are totally lost to them until the exam ends and suddenly they are able to remember the answers. A test anxious individual may experience all, some, or none of these symptoms depending on the situation and when not in a testing situation may not show anxiety or worry of failure at all (Zeidner, 1998).

Both the worry and emotionality aspects of test anxiety impact a person's ability to perform on tests. Worry impedes on task-focused thoughts with negative self-talk, doubt, and fear of failure as noted in the Cognitive Intervention Theory (Cassady & Johnson, 2002; Hembree, 1988; Sapp, 2014; Sarason, 1984; Zeidner, 1998). Emotionality can also have a negative impact when the bodily arousals such as increased heart rate, clammy hands, and physical illness distract from the task (Hembree, 1988; Tryon, 1980; Zeidner, 1998). It is a combination of both worry and emotionality in the test anxiety construct that causes the greatest negative impact on test performance and thus it is through the treatment of both that the greatest positive impact is gained (Hembree, 1988; Keogh & French, 2001; Zeidner, 1998).

Test Anxiety and Test Performance Research

Test anxiety research peaked in the 1980's with treatments ranging from relaxation techniques which improved anxiety, but not performance, and cognitive training which trained the individual to replace negative self-talk with task relevant statements (Tryon, 1980). Along with research on defining the test anxiety construct came the introduction of several measurements of test anxiety. These measurements formed the current test anxiety construct and have been used to determine treatment effectiveness. Culler and Holahan (1980) utilized an adaptation of the TAI-G to determine test anxiety levels of 800 first-year college students. They

split the group into two test anxiety groups: high test anxiety (HTA) defined as those scoring in the top 25% and low test anxiety (LTA) defined as those scoring in the lowest 25%. They then compared grade point averages of the groups and found that the LTA group ($M = 2.86$) had scored significantly higher than the HTA group ($M = 2.51$) with $t(94) = 2.24, p < .03$. Sarason (1984) also compared high and low anxiety groups, but rather than grades, he compared the relationship between subjects' responses to tests, test anxiety, cognitive interference, and performance. Sarason (1984) studied 385 undergraduates taking an introduction to Psychology course. Each student took two inventories (Response to Testing and Test Anxiety Scale) prior to taking a Digit Symbol test. After the test, the Cognitive Interference Questionnaire (CIQ) was given. He found that the high test anxiety scores were associated with both poor performance on the Digit Symbol test and high cognitive interference scores. A comparison of means between the high anxiety and low anxiety groups was significant at $F(1, 39) = 4.41, p < .05$ for test performance and $F(1,39) = 4.77, p < .05$ for cognitive interference. The CIQ's strong correlation with worry suggested that "cognitive interference and lowered performance are most likely to be related to thoughts that reflect fears of failure and comparison with others rather than thoughts that are merely irrelevant to the situation" (p. 934).

Another seminal work in test anxiety research is from Hembree (1988) who meta-analyzed 562 research studies (100 of which involved high school aged students) examining both cognitive and behavioral treatments that addressed both worry and emotionality. His research also addressed the effect of test anxiety on performance and anxiety. Hembree (1988) found that there was a significant positive correlation between the performance-related need for achievement and test anxiety in high school students more so than in other grade levels (K-8) or post-secondary (mean $r = .26$). High test anxious subjects experienced significantly more

difficulty with encoding (writing) and cognitive interference when compared to low test anxious groups, and had significantly more negative attitudes about the performance evaluation. High test anxious students were also more distracted and performed more poorly than those in the mid to low range.

The research by Hembree (1988) was evidence that test anxiety had a significant impact on test performance and further investigation of cognitive interference was necessary. Zeidner (1998) noted that all students may experience physiological arousal under a stressful evaluative condition, but those with test anxiety experience severe disruption from negative, worrisome thoughts; this is known as cognitive interference. If the mind is spending its resources trying to eliminate, block, or change the negative functioning that accompanies worry, then more capacity is put into solving the anxiety than into the performance task (Zeidner, 1998).

Ikeda et al. (1996) found that in a study of college-aged students categorized into high, middle, and low anxiety groups, there was a significant difference between the high and low anxiety groups on worry $F(1, 34) = 19.99, p < .001$ and cognitive self-concern $F(1, 34) = 29.40, p < .001$ with the high test anxiety group scoring significantly higher in both worry ($M = 3.35$ compared to 2.09) and cognitive self-concern ($M = 2.30$ compared to 1.35). The study found that subjects with high test anxiety took longer to process information and longer to maintain accuracy. This can be a major detriment to a student taking a high-stakes, timed test for college admittance. There is greater anxiety because of the importance of the test, causing greater interference of off-task, negative thoughts with limited time to cope with the distractions.

Similar results were found in a study by Keogh and French (2001) investigating the susceptibility to distraction of high test anxious participants and whether there is a difference between threatening and non-threatening distractions. This study involved 72 participants who

began by taking a test anxiety inventory to determine their test anxiety level. The researchers then studied participant reaction time with distractions of various types including irrelevant, relevant, threatening, non-threatening, and variations of two together as well as a control group with no distractions. Results indicated that distractors significantly slowed responses $F(1,68) = 595.18, p < .001$. They also found that high test anxious individuals had an increased susceptibility to distraction when compared with low test anxious participants. Concurring with Zeidner (1998), Keogh and French (2001) found that distraction and processing interruptions only occurred in individuals with test anxiety when in a situation perceived as threatening in regards to performance.

In an investigation of cognitive test anxiety and student performance, Cassidy and Johnson (2002) divided 168 participants into three groups based on their level of test anxiety (low, medium, or high) and administered the SAT and two course examinations to each student participant. Using the low and high anxiety groups, “a multivariate analysis of variance on the effect of level of cognitive test anxiety on performance on the SAT was significant at $F(4, 212) = 3.97, p < .005$ ” (p. 280). Results also indicated a “positive skewness toward A and B grades for the low anxiety students and a negative skewness toward the C and D grades for the high anxiety students” (p. 280). Nearly 8% of the variance in student performance was accounted for by cognitive worry. This cognitive interference can occur during the test, but also while preparing for the test which may lead to problems when studying for an exam and retrieving information during an exam.

Using an experimental design with 88 college students, Coy et al. (2011) offered variations in supportive and non-supportive instructions, as well as anxiety-inducing instructions and non-anxiety inducing instructions and asked students to rate their test anxiety. Participants in

the anxiety-inducing setting rated themselves higher in test anxiety and reported more negative self-talk and did not perform as well as those in the supportive instruction group. Negative self-talk “mediated approximately 41% of the variance in the relationship between the evaluation anxiety conditions and the phonological loop [cognitive task] performance” (p. 828).

The emphasis and importance placed on test performance and assessment in schools tends to cause greater examination stress and increase the levels of test anxiety in students making it an important topic for schools to address (Keogh & French, 2001). Research on test anxiety remains important across psychology disciplines in the exploration of achievement and performance including, but not limited to, educational, health, sport, and organizational psychology (Stöber & Pekrun, 2004).

Students with test anxiety struggle to maintain focus during exams as they battle relevant and irrelevant thoughts, feel both fearful and worried and suffer from tension and heart palpitations when faced with a testing situation (Lowe et al., 2008; Yeo et al., 2016). When this occurs during an exam, a student may not be able to fully demonstrate his/her true abilities (Lowe et al., 2008; McDonald, 2001; Zeidner, 1998). Utilizing extant research, McDonald (2001) found that the fear associated with test taking was not only common, but increasing in numbers. The detrimental effect, even when statistically insignificant, can have major implications for a student performing on a standardized test. This was confirmed by Keogh and French (2001) in a study of 72 undergraduates on their susceptibility to distraction. They found that students with high test anxiety were more distracted and had more problems concentrating than those with low test anxiety.

Zeidner (1998) indicates that as students approach high school, the reports of test anxiety rise perhaps due to higher demands, high-stakes testing, parent and peer pressure, changes in

complexity of learning and expectations, past failures, and future fears. Anxiety may facilitate performance for tasks perceived as easy, however it can be debilitating for tasks perceived as difficult. For the high anxiety tester, the competing error tendencies and negative thoughts can dominate over the correct response. High anxiety activates these dominant error tendencies and thus negatively impacts test performance.

Empirical evidence from prior research suggests that test anxiety is linked to deficiency in processing efficiency due to the increased amount of processing required to filter through unnecessary thoughts in test situations (Eysenck & Calvo, 1992). This interference comes mainly during the output of information. Test anxiety gets in the way of cognitive processes including encoding, memory, and processing such that a student is unable to retrieve information from long-term memory regardless of study time and prior knowledge (McDonald, 2001; Sarason, 1984; Zeidner, 1998). The negative thoughts which accompany test anxiety may be legitimate. Perhaps the student didn't study or doesn't know the material. On the other hand, the negative thoughts may be entirely unwarranted because outside of the testing setting the student may know all of the material and has studied an ample amount of time; however in the test situation, they have thoughts such as 'I didn't study enough' or 'I don't know this material, I am going to fail' (Sapp, 2014; Sarason, 1984). There is also a direct link between test anxiety and fear of negative evaluation. In high school students, test anxiety which is also linked to the need for achievement, led to students experiencing more difficulty encoding (writing) and more cognitive interference during tests than was experienced by younger age groups (Hembree, 1988).

Test Anxiety Treatments

Several treatments have been utilized since the 1950's in an attempt to alleviate test anxiety including relaxation, cognitive-attentional, and cognitive-behavioral training. Relaxation training, similar to meditation, was used as a self-controlled or cue-controlled relaxation (use of a psychological trigger to induce relaxation) in which participants worked to control their thoughts and stop or change them during a high stress exam situation (Hembree, 1988; Tryon, 1980; Zeidner, 1998). Relaxation training is directed toward modifying emotional reactions and helps with test anxiety as well as other anxiety producing situations. Once a person understands the triggers for anxiety, they work on a counter response exercise which may include deep breathing or muscle relaxation training (Zeidner, 1998). However, such relaxation training only treated the emotionality portion and not the worry portion of anxiety which tended to have a stronger negative impact on academic performance; therefore, it was necessary to practice cognitive skills training in addition to the relaxation exercises (Tryon, 1980).

Cognitive-attentional training is presented by Zeidner (1998) as giving individuals the means to focus on the task at hand and cease any negative self-talk or irrelevant thinking. It is the ability to redirect harmful or irrelevant thoughts to thoughts associated with solving the problem or working on the task at hand. Individuals are also taught to ignore distractions and inhibit self-deprecating and ruminative tendencies. Study skills training is another form of cognitive training which can help students at all levels of anxiety to be cognitively prepared; however, unless they are able to deal with the worry and emotionality components of test anxiety, high test anxious students will not benefit from the study skills training (Hembree, 1988; Zeidner, 1998). Tryon (1980) determined through a meta-analysis of 40 studies that the following two-part treatment had the greatest impact on student performance: (1) practicing the cognitive behavior modification outside of and prior to the testing setting, and (2) practicing the

relaxation techniques specifically in the moment they experienced test anxiety. In alignment with Tryon, Hembree's (1988) review of 137 test anxiety treatment studies, found that neither behavioral nor cognitive therapy alone was sufficient, but that when the therapy included both "cognitive modification, attentional training, insight therapy, anxiety management training and stress inoculation" (p.69), there was a significant impact on reducing test anxiety with a mean effect of $d = -0.53$. These treatments significantly reduced both the worry (mean effect of $d = -0.82$) and emotionality (mean effect of $d = -0.73$) components of test anxiety. The cognitive-behavioral interventions also had a significant mean effect on improved test performance ($d = 0.52$) and on grade point average ($d = 0.72$), bringing the performance level of high test anxious individuals closer to the level of those with low test anxiety who were untreated.

Cognitive behavioral training (CBT) is a multi-faceted approach that effectively addresses both the worry and emotionality components of test anxiety (Hembree, 1988; Sparfeldt, Rost, Baumeister, & Christ, 2013; Tryon, 1980; von der Embse et al., 2013; Yeo et al., 2016; Zeidner, 1998). CBT addresses both worry cognitions which may be more constant across time, and emotionality which appears in behaviors which peak immediately before or upon entering a threatening test situation. Although worry scores have a stronger correlation with test performance, emotionality correlates with worry therefore both must be addressed (Sapp, 2014). A combined approach to treatment including both cognitive restructuring to deal with negative self-talk and anxiety reducing methods such as meditation and breathing techniques to reduce anxiety addresses "the multiple manifestations of test anxiety, including negative motivational or affective tendencies, irrational thought patterns, and skills deficits, and emphasizes the application and transferring of acquired coping skills to test situations" (p.391) which results in reducing a person's test anxiety.

For any intervention to work, it must be practiced such that it becomes natural for the person to move into the process during a setting that elicits test anxiety (Zeidner, 1998). The addition of the practice of Mindfulness Based Cognitive Therapy, which is a combination of Mindfulness Based Stress Reduction and Cognitive Behavioral training, aims to address this issue (Baer, 2003).

Mindfulness Construct

Mindfulness is rooted in the Buddhist tradition of dharma which is centered around the concept of *Taoi* meaning ‘the way things are’ (Kabat-Zinn, 2003; Keng et al., 2011).

Mindfulness is a “coherent phenomenological description of the nature of mind, emotion, and suffering and its potential release, based on highly refined practices aimed at systematically training and cultivating various aspects of mind and heart via the faculty of mindful attention” (Kabat-Zinn, 2003, p. 145) and is based on the idea that humans often are not functioning at our fullest capacity which includes awareness of emotionality, somatic and intuitive experiences, and a cultivation of compassion for others (Kabat-Zinn, 2005). The Westernized interpretation of mindfulness differs from the Buddhist concept in that it is not based on a connection to an ethical code or end goal and is concerned with awareness of self and others as well as the environment (Keng et al., 2011). Mindfulness can be defined as a state of being rather than a trait someone possesses: an “innate psychological function that can be fostered by training” (Garland et al., 2009, p. 38). According to renowned practitioner and teacher, Kabat-Zinn (1994), “mindfulness means paying attention in a particular way: on purpose, in the present moment, and nonjudgmentally (p. 4), and “paying attention in this way opens channels to deep reservoirs of creativity, intelligence, imagination, clarity, determination, choice, and wisdom in us” (p. 9). It is practical in the sense that anyone can do it with intentional time and effort by utilizing the

processes of self-observation, self-inquiry, and mindful action. Focused attention involves sustained awareness and focus on an object such as breath sensation and that which is occurring within you and around you in that moment; allowing the mind to drift, but being aware that it is happening and bringing the attention back to the object; and allowing those thoughts to enter the mind, affirm that they exist, and then pushing them aside to refocus on the object or breath (Lutz et al., 2008; Renshaw & Cook, 2017).

The practice of mindfulness in the Western world was first introduced and is still used by Kabat-Zinn (2003) who began a Mindfulness Based Stress Reduction (MBSR) program as a means for helping patients to relieve suffering and stress due in large part to their clinical illnesses (physical and/or emotional). The MBSR program is a standardized practice lasting between eight to ten weeks with two-hour group sessions each week. During these sessions, participants have discussions, sitting meditation, body scan exercises, focused breathing exercises, yoga postures, and mindful practices of walking or eating. After the sixth week, there is a day long, silent retreat. Participants are asked to practice in the home for 15-45 minutes daily and may use a guided audio recording to assist (Baer, 2003; Kabat-Zinn, 2003; Matousek, Dobkin, & Pruessner, 2010; Vohra et al., 2019).

In her clinician's guide, Praissman (2008) offers insight into MBSR practices by defining mindfulness meditation as an observation of negative feelings and thoughts with a return to the present moment and acceptance of the thought without allowing the negativity to define one's person. The body scan begins with focused attention on the breath then moves to an observation of the sensations of each part of the body. During the sitting meditation, people are taught to focus on the present while acknowledging passing thoughts and moving them on to refocus on the present and simplicity of existence. Praissman clarifies that both MBSR and

Cognitive Behavioral Therapy focus on changing thought patterns, but CBT seeks to replace negative thought while MBSR accepts the negative thought, but does not dwell on it. MBSR is not meant to replace therapy, but to accompany treatment for greater benefits of the therapy. Another form of intervention is known as Mindfulness-based cognitive therapy (MBCT) and is centered around how a patient views his or her thoughts. MBCT combines the previous two practices by accepting thoughts for what they are and then learn how to move forward from that thought (Baer, 2003).

Mindfulness-based interventions and skills have been shown to help individuals dealing with painful emotions through non-judgmental observations and acceptance which increase the ability to cope by allowing negative emotions to pass while focusing on effective strategies for balancing levels of emotional reactivity in order to respond appropriately (Baer, 2003; Grossman, Niemann, Schmidt, & Walach, 2004; Kabat-Zinn, 1994; Keng et al., 2011). By allowing negative thoughts to pass without ruminating on them, cognitive functioning can increase and tension, stress, and autonomic arousal can be relieved creating a sense of peace where there may otherwise be chaos (Baer, 2003; Keng et al., 2011; Sowell, 2014). MBSR has continued to evolve over time; while originally intended for those with clinical diagnoses, disorders, or disease, it is now used for individuals across ages, stress levels, and situations (Williams, Kolar, Reger, & Pearson, 2001). In schools, the practice of mindfulness often refers to the time spent actively engaging in the discipline either through meditation, focused breathing, or conscientious awareness in daily activities. For example, a student is preparing for a test and as he is preparing has thoughts of 'I am going to fail', 'I am a failure', or 'I can't do this'. If he practices mindfulness at that moment, he would recognize that these thoughts are just that, thoughts. They are not describing him directly and do not define him. They can be pushed aside

to allow other thoughts to enter including thoughts of what he is currently studying. One can practice doing this often so that when faced with a stressful situation, such as a test, one is able to bring the practice into play almost automatically (Kabat-Zinn, 2003; Saltzman, 2014).

Research in Mindfulness

In his seminal work, Baer (2003) reviewed 22 mindfulness-based intervention programs including MBSR and MBCT and found that in all studies there was a significant improvement upon psychological functioning in both clinical and nonclinical populations ($d = .59$). Different than cognitive-behavioral training, MBCT does not work to change thoughts, but rather utilizes the mindfulness ideas of accepting one's thoughts as they are and moving on to focus on the present moment. In a study using community volunteers without a clinical diagnosis, Williams et al. (2001) utilized a repeated measures analysis of variance and a paired samples t-test to determine that there was a significant reduction of baseline perception of daily hassles, overall level of psychological distress, and number of medical symptoms. Additionally, effects were maintained three months later. Vohra et al. (2019) found similarly positive results in a study of youth participants living in an alternative home with a diagnosed mental illness who were not responding to treatment. After introducing a trial group to MBSR, these participants' adaptive skills increased significantly, and they had a significantly lower admission stay (150.60 compared to 132.80 days, $p = .02$).

Jha et al. (2007) utilized the Attention Network Test (ANT) to measure attention in two groups of mindfulness practitioners (one month long retreat group immersed in mindfulness ten hours per day, and the other participating in an eight-week MBSR course meeting for three hours each week) as compared to a control group with no mindfulness experience. The focus of the study was on differing forms of attention improved by levels of mindfulness training. Analyses

of variance were used to determine whether there was a significant difference in the groups from the first measure (pre-mindfulness experience) to the second (post experience). They found that after mindfulness training, the MBSR group improved their orienting ability compared to the control group and the treatment group demonstrated less interference in response time and accuracy than those in the control group.

In a mixed design study by Dobkin (2008), women who had completed breast cancer treatment received MBSR and then were assessed on coping, orienting to life, mindful awareness and perceived stress. Results showed significant reduction in perceived stress levels (20.62 to 14.46; $t = 3.17$, $p < .01$), and significant increase in mindfulness (3.98 to 4.43; $t = -2.51$, $p < .05$). Qualitatively, along with decreased feelings of stress, the participants reported changes in their ability to accept what life was bringing them, their ability to cope in more positive ways, and new recognition of their ability to change some things while accepting others.

In a review of 31 empirical studies (17 using MBSR and 14 using MBCT), Keng et al. (2011) found that “overall, evidence from correlational research suggests that mindfulness is positively associated with a variety of indicators of psychological health, such as higher levels of positive affect, life satisfaction, vitality, and adaptive emotion regulation, and lower levels of negative affect and psychopathological symptoms” (p. 1044). Results did not show a relationship between the amount of treatment and the response to treatment; however an examination of laboratory studies suggested that even brief mindfulness training such as guided meditation focused on developing an accepting attitude toward thoughts and external experiences can have an immediate, positive effect.

Parsons et al. (2017) did a meta-analysis of 28 studies on the impact of home practice of mindfulness and found a significant association between home practice and outcomes when the

home practice occurred 30 minutes per day. Audio recordings were found to be an important component of effective home practice. With mindfulness gaining momentum as a treatment for social disorders, Hjeltne et al. (2017) utilized a quasi-experimental design to examine the impact of MBSR on self-reported psychological changes specifically looking for a decrease in social anxiety disorder symptoms and psychological distress with an increase in mindfulness components of self-compassion and self-esteem. Forty-five students at the university level who attended at least 6 of 9 sessions were used in the analysis. There was a significant decrease in social phobia symptoms including obsessive compulsive behaviors, anxiety, and depression.

Awareness of what is happening leads to experiencing things as they are and responding as we choose, which in turn reduces anxiety through acceptance and allows for calm in the midst of any situation (Huppert & Johnson, 2010). The benefits of mindfulness can in fact alter a person's behavior without the realization that it is happening. Jon Kabat-Zinn (1994) referred to mindfulness as non-doing, and reported that those who allow time for non-doing may actually get more done and done better because it is about allowing things to unfold however they unfold and accepting them in that moment. This practice, in turn, can decrease anxiety by enabling the individual to "take charge of the direction and quality of their own lives" (p. 5). Weinstein et al. (2009) examined how the regulation strategies of mindfulness enhanced mental health and the ability to deal with stressful situations. They found that "more mindful individuals perceived less stress in immediate response to an induced social threat, as well as greater recovery 30 minutes later" (p. 378). Weinstein et al. (2009) also found that those with higher levels of mindfulness had "lower levels of mental health symptoms and higher levels of positive psychological experience" (p. 383). Similarly, Khoury et al. (2013) found that mindfulness

based therapy “showed large and clinically significant effects in treating anxiety and depression” (p. 769) and these effects and greater mindfulness qualities were maintained at each follow up.

Mindfulness allows a person to focus on the present moment with an awareness of what is happening in that particular moment (Kabat-Zinn, 1994). Those who practice mindfulness long-term have higher attention levels, improvement in working memory and other executive functions (Chiesa et al., 2011). In a study by Moore and Malinowski (2009), results indicated that mindfulness was linked to “greater attentional control, accuracy of visual scanning, inhibitory control, carefulness, cognitive flexibility and quality of performance” (p. 182). Further, studies show that the practice of mindfulness increases state and trait mindfulness as measured by the Child and Adolescent Mindfulness Measure, the Mindful attention Awareness Scale-Adolescent, the Mindful Thinking and Actions Scale for Adolescents, and the Kentucky Inventory of mindfulness Skills (Eklund et al., 2017; Moore & Malinowski, 2009).

Mindfulness Practice in Schools

Mindfulness practice in schools became popular in 2007 and included studies involving mindfulness practices with adolescents. Beauchemin, Hutchins, and Patterson (2008) introduced mindfulness to high school students with learning differences through a 45-minute mindfulness introduction followed by five weeks of a five to ten minute mindfulness meditation each day during school. They measured social skills, anxiety levels, and academic performance and found that both state and trait anxiety levels decreased significantly as measured by a paired samples t-test ($M = 32.59$, $t(33) = 4.88$, $p < .05$). Also, social skills and teacher ranked academic performance increased significantly from pre to post intervention.

The popularity of mindfulness began several school-wide initiatives from teacher training to classroom programs to individual student intervention (Renshaw & Cook, 2017).

Administrators, teachers and students witnessed the benefits of mindfulness including the ability to control reactions and emotions (Simpson, 2017) and reduce behavioral problems while increasing social-emotional well-being (Zalaznick, 2017).

The introduction of a school program ‘.b’ which stands for “Stop, Breath, and Be” was a mindfulness program designed for and used in schools (Simpson, 2017). Through the ‘.b’ program, which includes a brief core breathing practice three times each day for nine weeks, students were assessed prior to mindfulness practice, after, and three months later. Results showed that “mindfulness practices were significantly associated with well-being and lower stress” (Lawlor, 2014, p. 87). Teachers also reported that, after the implementation of ‘.b’ students were more socially competent, and they reported that implementation of ‘.b’ was easy.

Dr. Amy Saltzman (2014) introduced a mindfulness program based on MBSR for children, called “Still Quiet Place” (SQP). The focus of this program is pure and compassionate moment-to-moment awareness and it utilizes many of the fundamental elements of MBSR including non-judgment, acceptance, awareness, curiosity, non-striving, and the idea that it is universal. The program differs from MBSR by a decrease in the amount of time: MBSR sessions tend to last around 45 minutes, while SQP sessions consist of only 5-12 minutes of guided practice. Qualitatively, students practicing SQP have reported feeling better about themselves, getting along with others better, and having more control over their actions; however, SQP has not been evaluated as a stand-alone program (Semple, Droutman, & Reid, 2017). An adapted version of SQP for teens was introduced and developed as a means for adolescents to work independently on mindfulness practices including a focus on breath, thought, feeling, body, peace, and a process used for test taking experiences called STAR (Stop, Take a breath, Accept, and Resume) (Saltzman, 2016).

Other schools implementing mindfulness based education programs, which included five minutes of mindfulness at the start of class, reported more teachable time, fewer distractions, and fewer instances of student removal because of the use of mindful breathing (Zalaznick, 2017). In a study of 173 high school males, Huppert and Johnson (2010) found that after four weeks of one 40 minute session per week, students in the intervention group showed “significant improvement on measures of mindfulness and psychological well-being related to the degree of individual practice undertaken outside the classroom” (p. 270). Those who were higher in anxiety or neuroticism at the baseline obtained the greatest benefit from the mindfulness intervention. Huppert and Johnson (2010) suggested that future studies randomly place individuals in intervention and control groups to reduce bias.

Research on Mindfulness and Test Performance

Mindfulness is a tool which can be utilized by any person and although the results may vary from person to person, there have consistently been beneficial results (Kabat-Zinn, 1994; Simpson, 2017). Training in mindfulness is “likely to have beneficial effects on learning, problem solving, decision-making and other cognitive processes” (Huppert & Johnson, 2010, p. 265). In reviewing current research, Renshaw and Cook (2017) determined that further research is necessary for outcomes related to academic achievement and behavior as mindfulness is often marketed to schools without sufficient evidence of effectiveness. Eklund et al. (2017) concurred and stated that since matters of discipline referrals, attendance, statewide achievement test scores, and academic performance are important to educational stakeholders, “the examination of mindfulness measure’s capacity to predict these variables [is] particularly crucial” (p. 102). While there remains a substantial amount of research yet to be done, no studies thus far have shown any harm from the implementation of a mindfulness program at any level (Renshaw &

Cook, 2017), and there is clear support for continuing the study of mindfulness practices in the cognitive realm based on the benefits on cognitive measures as well as the ability to be flexible, to re-focus, and re-engage in the moment (Chiesa et al., 2011).

Although Keogh and French (2001) were among the first to confirm the issues that individuals with test anxiety faced in regards to focus and susceptibility to distraction, there are many more following suit including von der Embse et al. (2013). After a systematic review of treatment studies through 2010, von der Embse et al. (2013) reported that “we need to support the implementation and dissemination of research that advances school psychologists’ knowledge and expertise in the treatment of test anxiety” (p. 70). They found that interventions which included anxiety reduction and/or cognitive behavioral methods were both effective; however, the most effective interventions utilized a combined approach.

Societal Benefits

The practice of mindfulness could have positive benefits on standardized test performance, but the benefits would not stop there: the non-judgment fostered by mindfulness allows individuals to improve awareness, become self-regulated and balanced, more effective in our daily activities, and thus more thoughtful and ethical in our actions (Eklund et al., 2017; Kabat-Zinn, 1994). Mindfulness decreases stress and increases cognitive functioning, attention, and concentration, which allows individuals to respond in appropriate ways rather than quick reactions that often lead to trouble or misunderstanding (Sowell, 2014). Further, mindfulness is a tool accessible at any time, by anyone and, although it does require training to become truly aware, achievement of complete awareness is not required in order to begin reaping the benefits of the practice (Kabat-Zinn, 1994; Lawlor, 2014; Zalaznick, 2017).

Through a decrease in the adverse effects of test anxiety on test anxious individuals, we, as a society, will better know a person's academic potential to the extent that it can be measured by a test (von der Embse et al., 2013). Test anxious students are not only affected during exams, studies have also shown detrimental effects in time management, organization skills, and preparation. According to Zeidner (1998), test anxious students also "have difficulty encoding information, organizing information into larger patterns of meaning, and effectively employing metacognitive processes such as self-monitoring" (p. 49). Mindfulness is for anyone and everyone in that it is not about changing something in a person that is perceived as wrong or bad, but about accepting and cultivating one's inner resources and ability to think more clearly and understand one's own thoughts (Kabat-Zinn, 1994).

Theoretical Framework

The research method used in the present study is based on a mindfulness cognitive training framework intended to reduce a student's test anxiety level through anxiety reduction techniques (focused breathing) as well as the use of cognitive restructuring techniques (passing thoughts) through guided mindfulness practice with an exam focus addressing both the worry and emotionality components of test anxiety (Baer, 2003; Keogh & French, 2001; Parsons et al., 2017; Saltzman, 2014; Sapp, 2014; Zeidner, 1998). According to Zeidner (1998), cognitive behavioral training "is based on the premise that reducing a person's level of test anxiety involves both anxiety reduction training as well as detailed cognitive restructuring of certain faulty beliefs or misconceptions concerning evaluative situations" (p. 373). The model offered by Zeidner suggests that an evaluative situation such as a test leads to an individual's perception of a threat due to the demands of performing well. This in turn affects the individual's focus dividing it between cognitive tasks of the test and self-related, irrelevant thoughts known as

Cognitive Interference Theory (Culler & Holahan, 1980; Sarason, 1984; Zeidner, 1998). The division of thought leads to poor concentration on the task which in turn leads to poor task performance. Zeidner also references a cognitive-attentional model which suggests that reduction of test anxiety comes from training based on focusing attention on task related variables and off the self-destructive thoughts.

Based on the research by Baer (2003), Keng et al. (2011), and Zeidner (1998) as well as the practice developed by Saltzman (2016), I hypothesized that if test performance is negatively impacted by a lack of focus (worry) and by anxiety (emotionality), and if, through the practice of a combined approach mindfulness meditation, anxiety can be decreased and focus increased, then a positive impact on test performance would result (see Figure 2.1).

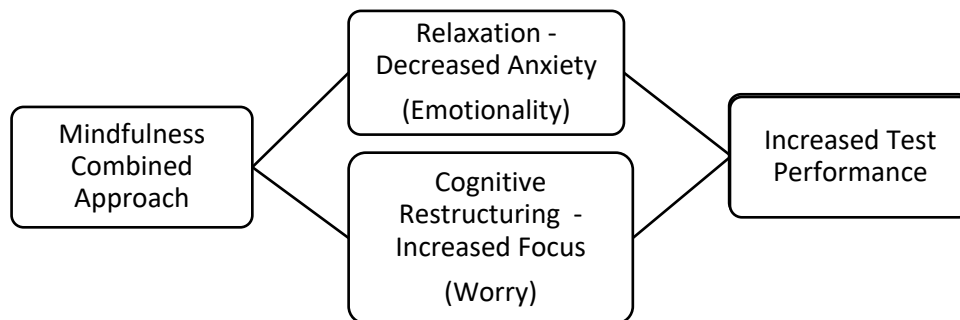


Figure 2.1. Mindfulness Model for Test Anxiety Intervention

Method

Participants

Participants for this study included high school sophomores, both male and female, in a midwestern city who planned to take the ACT for college admittance and had completed the majority of necessary coursework to cover the material presented on the ACT (a required test for

all Jefferson county students). Qualifying students reported no prior mindfulness training, did not participate in an ACT preparation course during the 5 week intervention, and had taken the ACT at least one time prior to the treatment to ensure that results are not due to an exposure effect from time one to time two (Andrews & Ziomek, 1998). All participants were asked to sign a letter of assent and a letter of consent was sent home to parents along with an explanation of the research purpose, activities during research, and necessity for on-going participation during each session and at home practice (Kabat-Zinn, 2003; Keng et al., 2011).

Context/Setting

All students came from three local high schools and participated in the intervention after school hours on a volunteer basis. High school sophomores who had volunteered to participate in the study were given two unofficial ACT tests (scores will not be shared with high school or college), however, students were informed of the magnitude of the test, the necessary benchmarks to achieve, and were in testing rooms similar to that of an official ACT national test in order to create a simulated testing environment (Keogh & French, 2001; Zeidner, 1998). The ACT tests were given on Saturdays (one before the intervention and one after) to control for school related stress or burnout on a given day. Since this test is a requirement for all Jefferson County high school students and it is considered a high-stakes test, it seemed fitting to utilize it in the study.

In addition to the ACT, the students took the Test Anxiety Inventory – German Version (TAI-G) (Hoferichter, Raufelder, Ringeisen, Rohrman, & Bukowski, 2016; Mowbray, Jacobs, et al., 2015; Ringeisen et al., 2010) before each ACT examination. A body temperature measurement was taken using the Biodot (Dyke, 2016; Schultz & Schultz, 2014). The Biodot measures outer body temperatures by color from black (87° F) to violet (94.6°F) with black

signifying high anxiety (low body temperature) a possible physiological effect of test anxiety (see Figure 3.2.1). Biodot measurements were taken weekly for the intervention group to determine validity and effect of the mindfulness practice on anxiety levels.

All mindfulness training sessions utilized a pre-recorded session based on a program by Dr. Amy Saltzman from her program called “A Still Quiet Place for Teens” (2016). This audio session was based on three of her guided sessions including one on rest, one on thoughts, and one on STAR – Stop, Take a breath, Accept, and Resume (see Appendix C). This method addressed the worry (cognitive) aspect of test anxiety through the learned practice of allowing thoughts to happen, recognizing them as thoughts, and then pushing them to the side to allow the mind to refocus. It addressed the emotionality (physiological) aspect through the relaxation in the still, quiet place of resting and being and allowing the muscles to relax. It further addressed the cognitive aspect by guiding them through the STAR process when they encountered test anxiety having them picture themselves taking the exam and then guiding them through a process of dealing with that situation as noted in previous studies (Hembree, 1988; Tryon, 1980; Zeidner, 1998). Students were also electronically sent a recording of the session and asked to practice (listen in stillness) at least once on their own each week after they have been introduced for the first time during our first session. This home practice was a necessary part of understanding mindfulness and allowing it to become a natural progression when needed (Kabat-Zinn, 2003). Each mindfulness session took place in the same classroom at the same time of day at each of the participating schools in order to have consistency in environment and distractions such as noise in the halls, bell tones, announcements, room temperatures (kept around 70 degrees when possible), desks (arrangement and position sitting in a chair), and overall feel of the general environment. The 12 minute guided session was determined after conversation with Dr.

Saltzman and through work with my dissertation committee through Bellarmine University. All plans were submitted to and approved by the Bellarmine University IRB.

Sampling and Approach

Proposed Sampling and Approach

The original design for this research was based on apriori study parameters derived from G*Power software for a one-tailed, mixed ANOVA with one within factor and one three level between factor powered to detect a moderate effect size, $\alpha = .05$ and $\beta = .05$ (Faul, Erdfelder, Lang, & Buchner, 2007). G*Power results yielded the need for 60 participants, 20 in each of three distinct groups. I planned to visit several private, local high schools in the area to present the students with this research opportunity and solicit volunteers. Participants would benefit from exposure to two free practice ACT tests (Andrews & Ziomek, 1998). Each student was randomly assigned a number to protect his/her identity. Each participant would take a survey with questions about the amount of time they have already studied for the ACT, their current mindfulness practices, and their current grades (which would then be converted to an unweighted GPA), gender, and course load to account for any variation due to student ability grouping or current practice (see Appendix A). Each student also took the TAI-G to determine his/her baseline level of test anxiety in order to track whether the mindfulness practice would effect individuals with different levels of anxiety (low, medium, and high) in different ways, and a Biodot scoring of exterior body temperature to introduce participants to the measurement and obtain a baseline for the physiological impact of the test they were taking at the start of the practice ACT. After taking the first ACT test and TAI-G, I used a stratified random sampling approach to assign participants to an intervention group based on their anxiety level. I would then split them into equal groups as shown in Figure 3.2 (Cassady & Johnson, 2002).

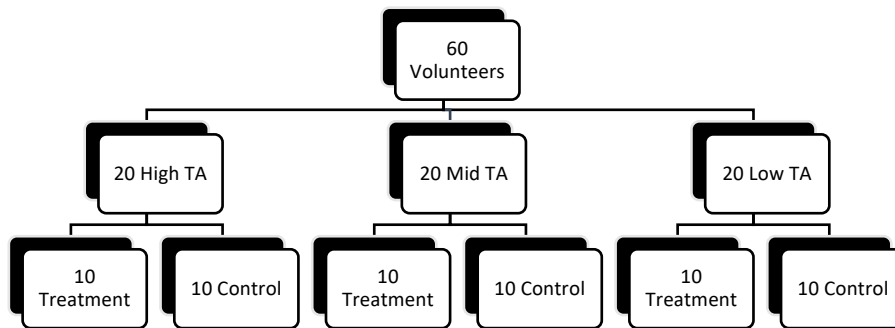


Figure 3.1. Sampling Approach

Modified Sampling and Approach

The research method had to be modified due to a low number of volunteers to take the pretest. After 40 volunteers had committed, a new power test was run to be sure there was enough power to proceed with a repeated measures test. A post hoc power test on the modified design, a one-tailed, mixed model ANOVA with one within factor and one two-level between factor and a sample size of 40, $d = .40$, $\alpha = .05$ still yielded a high power, $\beta = .05$ (power = .95) (Cohen, 1973; Faul et al., 2007). Using two groups without the variation in gender, anxiety level, or GPA, there was enough power. I recruited from three different private, local high schools in the area. I travelled to each school and spent the day talking to all sophomores about test anxiety, mindfulness, and the research that I was taking on to complete my dissertation. I originally had full support of the school during the school day, however, due to their scheduling concerns, it needed to take place after school. Volunteers, $n = 43$, benefitted from exposure to two free practice ACT tests (Andrews & Ziomek, 1998). Student ACT scores were scored by TorchPrep and shared with the student after the research had ended.

After taking the first ACT test and TAI-G and biodot inventory, the participants were randomly assigned a number and then the put into numerical order with one half assigned to the

intervention group, the other to the control group (see Figure 3.2). Each participant took a pre and post survey with questions about the amount of time they have already studied for the ACT, their current mindfulness practices (to be sure they were not currently practicing), and their current grades (which would then be converted to an unweighted GPA), gender, and course load to account for any variation due to student ability or current practice (see Appendix A). The survey information was used to determine consistency and any changes from pre to post test (Cassady & Johnson, 2002; Hembree, 1988). Each student took the TAI-G to determine his/her baseline level of test anxiety and a recorded a Biodot reading of exterior body temperature (based on color of the biodot) to introduce participants to the measurement and obtain a baseline for the physiological impact of the test they were taking at the start of the practice ACT.

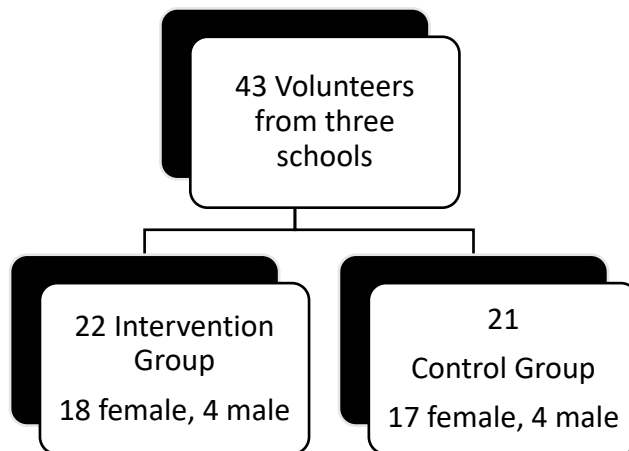


Figure 3.2. Modified Sampling Approach

Intervention

Participants were sorted using a random number generator and assigned to one of two groups based on their number with equal numbers in each group.

1. Intervention Group in which students would receive mindfulness meditation practice in person as a group once per week for 5 weeks for a 12 minute pre-recorded session with the session repeated as a group twice each week. The sessions were a recording based upon Amy Saltzman's "A Still Quiet Place" (2016) and included a brief introduction of mindfulness theory and practice during the first session. The recorded meditation was 12 minutes in length with the same focus each week – rest, thoughts, and STAR all to address test anxiety. This short recording was based on research that even a short amount of mindfulness practice can have an impact, and the guided meditation model provided by Dr. Saltzman (Beauchemin et al., 2008; Saltzman, 2016; Semple et al., 2017).

The students were encouraged to practice breathing and being mindful on their own on the days we were not meeting using the same recording (distributed electronically to all participants in the intervention group). The intervention group also participated in the same pre-recorded session prior to the start of the post-intervention ACT exam. The intervention group took a Biodot body temperature measurement every week during the first session of the week and before the second ACT exam to aide in monitoring the changes in the body temperature due to the practice of mindfulness.

2. Control group in which no intervention occurred. Students were administered the pre ACT, TAI-G, and biodot inventory as well as they survey prior to being separated into two groups. After 6 weeks of no mindfulness practice or additional ACT prep, participants were given the post ACT, TAI-G, biodot reading, and survey.

Both groups were administered the TAI-G followed by the ACT at a simulated ACT test site reviewing the importance of the ACT test and the benchmarks required to pass the test before

taking the TAI-G and the ACT. Along with the TAI-G, participants recorded the color of their Biodot.

After 5 weeks of mindfulness intervention for the treatment group, both groups met in separate spaces at which time post TAI-G was administered to both groups followed by the ACT with the Biodot replicating the procedures to administer as in the first exam for the control group. The intervention group participated in the same pre-recorded mindfulness session and pre and post Biodot reading prior to taking the TAI-G and the ACT for the second time. All students also completed the same survey at the second test regarding ACT prep, Mindfulness practice, and current grades. Upon completion of the post-test, all students in the control group and intervention group were given information about the mindfulness program “A Still Quiet Place” (Saltzman, 2014, 2016) and access to the mindfulness resources used in the research.

Data Collection

All participants began the research with a Biodot reading, a full-length, practice ACT, and the TAI-G. The research culminated in a Biodot reading, a second full-length ACT and TAI-G. Data was collected from every participant using the ACT Pre and Post-test composite scores and scores in each subject area as well as their score on the TAI-G. The ACT's were provided and scored by a professional practice test company, TorchPrep™, based in Cincinnati, Ohio. The TAI-G was provided by Dr. Mowbray and scored by the researcher based on a key provided by Dr. Mowbray (Mowbray, 2018). Biodots were purchased online from StressStop.com. The Biodot is a skin temperature measure using a small sticker that acts as a biofeedback measurement which changes color in response to skin temperature (Balk et al., 2009). Biodot readings were used as a measurement of external body temperature on the top of the hand at the base of the forefinger and thumb (see Figure 3.1). Biodot scores were based on

the recorded color of their biodot as follows: black = 6, brown = 5, amber = 4, green = 3, blue = 2, violet = 1; colors in between were given .5 fewer points such that a green/blue was recorded as a 2.5 while a blue-violet would be a 1.5.

The Biodot color was recorded as a baseline before the first test at the start of the test for all participants. Further biodot readings were taken once per week with the intervention group both before and after the mindfulness session. The students recorded the color of the dot on their hand each time and the mindfulness facilitator verified the color. This was possible due to the small number of students in the room. Data was also collected from the informational surveys about ACT and mindfulness practice as well as current grades.

Analysis and Design

Analysis of the data was broken down into two parts based on the research questions: 1) What is the impact of mindfulness practice on standardized test scores and 2) What is the impact of mindfulness practice on test anxiety levels. The analysis began with a post hoc power analysis using G*Power (Faul et al., 2007) to determine if the design yielded adequate power and was followed with an investigation of model adequacy to verify the assumptions of the general linear model had been met. To determine the impact of mindfulness practice on standardized test scores (research question 1), I used a mixed model, full-factorial ANOVA to determine three effects; one within subjects (pre and posttests), one between subjects (treatment and control), and the interaction effect. This analysis was used for each of the tests and subtests (ACT Composite, English subtest, Math subtest, Reading subtest, Science subtest, and the TAIG).

To determine the impact of mindfulness practice on anxiety, specifically the physiological aspect, I used a one way repeated measures ANOVA with the six interventions as

the independent variable. Follow up tests would be run depending on the results from the initial tests. All statistics were carried out using SPSS 25 for a Macintosh Computer.

Results

After visiting three local, private schools, I was able to recruit 40 student participants (8 males, 32 females) for the study who met the criteria of taking the ACT only once, and not practicing mindfulness on a regular basis. Due to the sample size, the design of the study had to be altered slightly to ensure there would be enough power to detect moderate effects. The 40 participants were randomly assigned into the control and treatment groups, however, they were not grouped by gender, anxiety level, or any other variable. The other information provided in the survey (GPA and course load) were also insignificant due to small sample size. However, a post hoc power test on a one-tailed, repeated measures ANOVA with a sample size of 40, $d = .4$, $\alpha = .05$ would still yield a high power, $\beta = .05$ thus I was able to continue with the research and analysis.

Once the continuation of the study was established and all 40 participants had taken the pre-ACT, Biodot reading, survey, and the TAIG, the interventions began. They took place in two different schools twice a week for 5 weeks and then once more just before taking the ACT, TAIG, and survey again 6 weeks after the initial test. Biodot readings were also taken before and after the mindfulness practice during the first session each week. Due to sample attrition, I ended with 34 students taking both the Pre and Post Tests (18 in the treatment group, 16 in the control). Of the students participating in the Mindfulness practice, the average attendance was 8.5 out of 11 days with a range from 1-11 days. The Pre and Post Biodot information for the control group could not be used due to the testing room conditions. In order for the Biodot to be most effective, the room temperature should be between 70-75 degrees Fahrenheit. The first

room was cold enough for students to wear jackets and sweatshirts and comment on the temperature (set at 70 degrees F) causing the potential for a lower temperature reading and a false high anxiety level interpretation. In the second room for the control group, which was proctored by another individual, it was reported after the fact that during the first portion of the test the air conditioning had shut off and they did not know how to turn it back on and so it was warmer than 75 degrees resulting in a potential false low anxiety Biodot reading.

The Impact of Mindfulness on Test Scores

Before beginning the analysis on the test variables, descriptive statistics were run (see Table 4.1) to examine the initial data within the mindfulness treatment group and the control group.

Table 4.1

Summary of Descriptive Statistics for ACT, Subtest, and TAIG Results

	N		M		Mdn		SD		95% CI	
	Mind	Control	Mind	Control	Mind	Control	Mind	Control	Mind	Control
Eng 1	19	21	21	21.52	21	22	4.97	4.57	[18.11,23.89]	[18.83,23.39]
Eng 2	16	18	20.81	21.56	20	22	5.76	5.86	[17.74,23.88]	[18.64,24.47]
Math 1	19	21	19.16	20.1	19	19	3.29	3.39	[17.08,20.67]	[18.11,21.34]
Math 2	16	18	18.81	20.72	18.5	20	2.88	3.98	[17.28,20.35]	[18.74,22.70]
Read 1	19	21	21.68	22.43	23	24	4.84	6.10	[19.03,24.09]	[18.41,23.59]
Read 2	16	18	21.44	21.33	20	21	5.01	4.27	[18.77,24.11]	[19.21,23.46]
Sci 1	19	21	21.53	21.19	22	21	4.59	5.08	[18.63,23.75]	[18.07,23.26]
Sci 2	16	18	20.88	20.44	20	20	4.46	2.83	[18.50,23.25]	[19.04,21.85]
ACT Comp 1	19	21	21.05	21.43	20	22	3.85	4.08	[18.70,23.05]	[18.87,22.69]
ACT Comp 2	16	18	20.56	21.22	20	21	3.98	3.67	[18.44,22.68]	[19.40,23.05]
TAIG Pre	19	21	42.47	43.43	44	41	10.73	9.32	[36.13,47.74]	[38.58,48.31]
TAIG Post	16	18	38.56	41.78	40	39.5	9.85	9.75	[33.32,43.81]	[36.93,46.63]

The descriptive statistics showed means for each pretest falling within the confidence intervals for the posttest groups indicated that a significant difference in unlikely. The bivariate

correlations also (see Table 4.2) showed a strong association between content area scores such that those who do well in one area do well in others and those who do poorly in one do poorly in others. The TAI-G test anxiety score does not appear to have a strong correlation with how a student performs on the ACT.

Table 4.2

Bivariate Correlation Table Between ACT Composite, Subtests, and TAIG

		Eng 1	Math 1	Read 1	Sci 1	ACT 1 Composite	Eng 2	Math 2	Read 2	Sci 2	ACT 2 Composite	TAIG 1	TAIG 2
Eng 1	<i>r</i>	1.00											
Math 1	<i>r</i>	.70**	1.00										
Read 1	<i>r</i>	.67**	.57**	1.00									
Sci 1	<i>r</i>	.64**	.64**	.63**	1.00								
ACT 1 Composite	<i>r</i>	.87**	.82**	.86**	.85**	1.00							
Eng 2	<i>r</i>	.83**	.53**	.74**	.49**	.77**	1.00						
Math 2	<i>r</i>	.58**	.82**	.60**	.54**	.74**	.65**	1.00					
Read 2	<i>r</i>	.71**	.51**	.78**	.63**	.79**	.74**	.60**	1.00				
Sci 2	<i>r</i>	.62**	.50**	.51**	.51**	.63**	.59**	.43*	.61**	1.00			
ACT 2 Composite	<i>r</i>	.83**	.68**	.79**	.63**	.87**	.92**	.79**	.88**	.76**	1.00		
TAIG 1	<i>r</i>	-0.18	0.03	-0.08	-0.02	-0.09	-0.15	0.08	-0.08	-0.12	-0.09	1.00	
TAIG 2	<i>r</i>	-0.15	0.11	-0.07	-0.11	-0.09	-0.08	0.20	-0.08	-0.11	-0.03	.81**	1.00

To test whether variability in standardized test performance can be explained by the practice of mindfulness, a mixed model full factorial ANOVA was run testing the null hypothesis that there was no difference in test scores (ACT or TAIG) between the control and treatment groups and second hypothesis of no difference from the first test to the second within the groups for each of the subtests (English, Math, Reading, and Science). The ANOVA tested the differences in the pre and post test scores, the within factor; differences between the intervention and control groups, the between factor; interaction effects resulting from significant variation in the simple effects of within (pre-post) by between (treatment-control). The results of the analysis are summarized in Table 4.3 and indicate that there are no meaningful statistically significant differences for any of the three tested effects.

The significance of the within subjects pre and post TAI-G do not enhance this research as it is occurring across subjects in both the treatment and control groups. Without a larger sample, the results will not yield enough power to be significant.

Due to the small sample size and attrition rates in this particular study, the research is inconclusive as to whether there is an effect on test scores within the treatment group.

Table 4.3

Mixed Model Full Factorial ANOVA

Source	Factor	Type III SS	df	MS	F	<i>p</i>
ACT	Pre-Post	0.07	1	0.07	0.04	0.85
ACT	Interaction	2.43	1	2.43	1.25	0.27
ACT	Treat - Cont	1.34	1	1.34	0.05	0.83
ENG	Pre-Post	0.28	1	0.28	0.05	0.82
ENG	Interaction	1.69	1	1.69	0.32	0.58
ENG	Treat - Cont	3.09	1	3.09	0.06	0.81
Math	Pre-Post	3.72	1	3.72	1.77	0.19
Math	Interaction	4.78	1	4.78	2.27	0.14
Math	Treat - Cont	32.19	1	32.19	1.52	0.23
Read	Pre-Post	0.18	1	0.18	0.04	0.85
Read	Interaction	0.89	1	0.89	0.18	0.68
Read	Treat - Cont	1.88	1	1.88	0.05	0.83
Sci	Pre-Post	1.21	1	1.21	0.12	0.73
Sci	Interaction	0.04	1	0.04	0.00	0.95
Sci	Treat - Cont	3.83	1	3.83	0.13	0.72
TAI-G	Pre-Post	107.65	1	107.65	5.66	0.02*
TAI-G	Interaction	12.36	1	12.36	0.65	0.43
TAI-G	Treat - Cont	94.44	1	94.44	0.52	0.48

*Significant at $p < .05$

Impact of Mindfulness on Test Anxiety

In order to examine the Biodot data and the impact mindfulness has on the physiological effect of body temperature, two new variables were computed. The first is an overall average Pre Biodot score (BD1-BD6) and the average Post Biodot score after participating in a mindfulness meditation practice (BD1-BD6) as shown in Table 4.4. The overall difference in means from Pre to Post Biodot score was also computed for each Biodot measurement. The measurements were taken approximately one week apart with the exception of the 6th occurring 2-3 weeks after the final mindfulness practice session just before the post ACT and TAI-G tests. Table 4.4.

Summary of Descriptive Statistics for Pre and Post Biodot Measurements

	n	Pre Biodot		Post Biodot		Difference*
		M(SD)	95% CI	M(SD)	95% CI	
BD1	14	5.71 (.83)	[4.91,6.29]	3.25 (1.4)	[2.20,4.11]	2.46
BD2	17	5.53 (.87)	[4.80,6.20]	3.59 (1.36)	[2.42,4.27]	1.94
BD3	15	5.00 (1.25)	[4.54,6.06]	3.17 (1.53)	[2.09,4.31]	1.83
BD4	15	5.20 (1.08)	[4.11,5.89]	3.33 (1.36)	[2.40,4.70]	1.87
BD5	14	5.71 (.47)	[5.35,6.05]	3.93 (1.47)	[2.62,4.89]	1.78
BD6	16	5.44 (1.03)	[4.32,6.08]	4.06 (2.05)	[2.45,5.55]	1.38
Average	18	5.49 (.53)	[4.96,5.81]	3.66 (1.22)	[2.56,4.44]	

Before examining this further, a test of bivariate correlation was run (see Table 4.5).

Table 4.5

Bivariate Correlation Table Between Pre and Post Biodot Scores

		BD 1:1	BD 1:2	BD 2:1	BD 2:2	BD 3:1	BD 3:2	BD 4:1	BD 4:2	BD5:1	BD 5:2	BD 6:1	BD 6:2
BD 1:1	<i>r</i>	1											
BD 1:2	<i>r</i>	0.33	1										
BD 2:1	<i>r</i>	.84**	0.34	1									
BD 2:2	<i>r</i>	0.46	.54*	0.4	1								
BD 3:1	<i>r</i>	-0.03	0.33	-0.12	0.23	1							
BD 3:2	<i>r</i>	0.33	.75**	0.42	.61**	0.43	1						
BD 4:1	<i>r</i>	-0.06	0.22	-0.1	0.14	.56*	0.29	1					
BD 4:2	<i>r</i>	0.34	.74**	0.38	0.3	0.45	.87**	.53*	1				
BD 5:1	<i>r</i>	.67*	0.41	0.3	.58*	0.08	0.21	-0.21	0.18	1			
BD 5:2	<i>r</i>	0.41	.69**	.51*	.53*	-0.06	0.43	-0.35	0.42	.51*	1		
BD 6:1	<i>r</i>	.64**	.49*	.54*	0.33	-0.22	0.29	-0.09	0.16	0.22	0.34	1	
BD 6:2	<i>r</i>	0.34	.51*	0.35	0.04	-0.36	0.32	-0.15	0.37	0.02	.51*	.62**	1

** Correlation is significant at the 0.01 level (1-tailed).

* Correlation is significant at the 0.05 level (1-tailed).

The majority of the correlations are between the pre-tests, however there are a few that occur between pre and post measurements. This could be due to a small sample size and/or extraneous variables. In theory, 1:1 (session 1, pre-intervention measure) should correlate to 2:1 (session 2, pre-intervention measure), 3:1, 4:1, etc. while 1:2 (session 1, post-intervention measure) correlates to 2:2 (session 2, post-intervention measure), 3:2, etc. While the latter (correlations among post-intervention measures) does appear to hold true, it does not have the same result for later trials. This may be due to students coming late, some progressing after attending more often and others not progressing due to lack of attendance. These significant correlations suggest that there is significance in their relationship and should be investigated further.

A single factor, repeated measure ANOVA was run to test for significant differences in Pre and Post Biodot scores over the 6 sessions (see Table 4.6) to test the null hypothesis that there was no change in the difference over time. There was no significance reported; however, one session, the 5th, appeared to be an outlier (see Figure 4.2).

Table 4.6

Single Factor Repeated Measures ANOVA on Differences from Pre to Post

	Type III SS	df	MS	F	Sig.
Difference	10.98	5	2.2	1.96	0.1

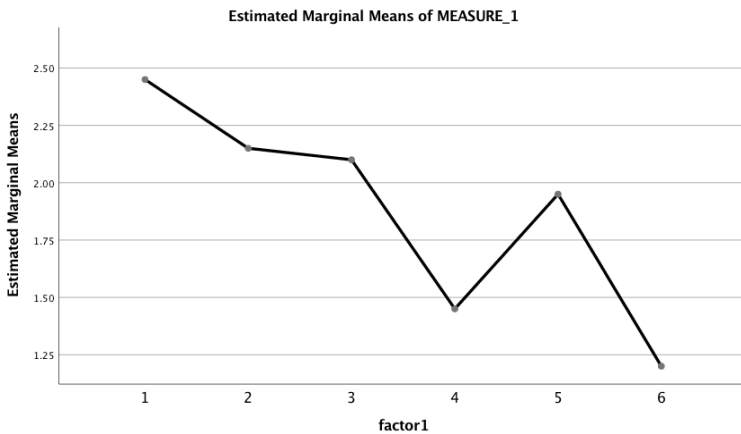


Figure 4.2 Chart of Mean Differences in Biodot Pre and Post Readings Across Six Sessions

It was noted in the field notes that the session with girls ($N = 10$) had extenuating circumstances that day. These included the session being held on the last day of school before spring break for the school; the students were noted as being on edge and anxious to leave; one fell asleep, another was constantly looking around, and there were several announcements causing the start time to be late and four students asked about missing their bus because of the delay. These circumstances may have led to a higher anxiety level at the start of the session than the previous times. When the repeated measures ANOVA was run excluding this date, sphericity was assumed ($p = .29$) and a test of within subjects effects was significant at $F = 3.12(4)$, $p = .03$, $\eta^2 = .24$. Tests of within subjects contrasts also showed a significant linear relationship at $F = 7.79(1)$, $p = .02$ (see Table 4.7 and Figure 4.3). This information suggests that the gap between differences in anxiety levels could be decreasing over time.

Table 4.7

Test of Repeated Measures ANOVA

	Type III SS	df	MS	F	Sig.
Difference	15.48	4	3.87	3.12	0.03*
Contrasts	15.28	1	15.28	7.79	0.02*

* Significant at $p < .05$

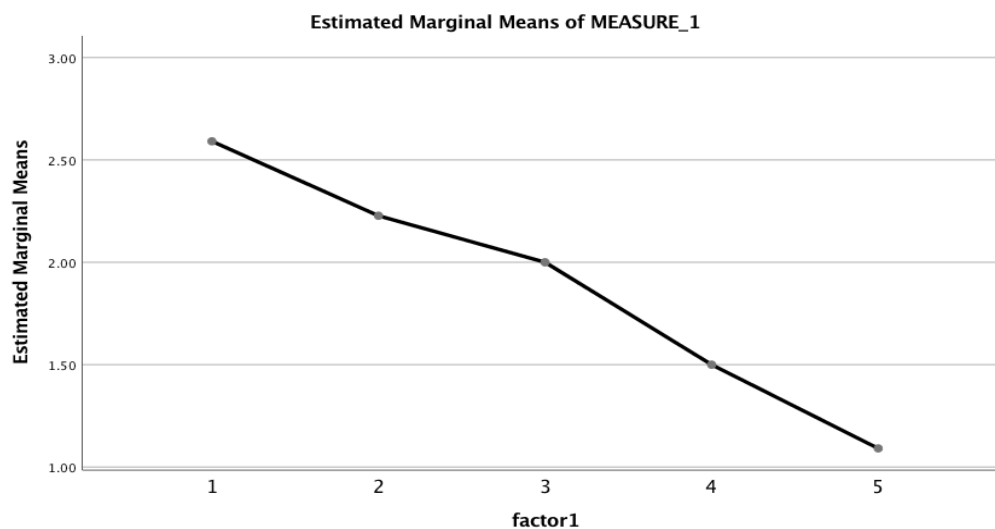


Figure 4.3 Chart of Pre-Post Biodot Differences with Outlier Excluded

During the first 4 sessions, the beginning anxiety level decreased with each session. The final intervention was higher possibly due to the fact that they were there to take the ACT again, however, the anxiety level was down for the second ACT ($M = 5.44$, $SD = 1.031$, $N = 16$) compared to the first ($M = 5.75$, $N = 16$, $SD = .775$) though not significantly lower.

In looking at the field notes and descriptive statistics critically, every mindfulness session had extraneous factors including attendance and distractions such as yelling in the halls, students late from field trips, room temperature or music playing. In examining the survey data, students

did not record practicing mindfulness outside of the person to person group sessions. The sessions were not likely to be dependent on a previous session; therefore, the trials could be seen as independent from one another. Given these factors noted in the journal and the impact of eliminating the outlier in the 5th factor, I elected to run a paired samples t-test which examined the difference between each trial and the effect of the meditation on anxiety level as it relates to body temperature.

The paired samples t-test on the Pre and Post Biodot averages showed a significant difference in the scores for the Pre Biodot ($M = 5.49$, $SD = .53$) and the Post Biodot ($M = 3.66$, $SD = 1.22$) conditions; $t(17) = 8.13$, $p < .001$. The results suggest that mindfulness has an overall significant impact on physiological anxiety as measured by body temperature with the Biodot (see Table 4.8).

Table 4.8

Paired Samples T-Test on the Pre and Post Biodot Averages

	M	SD	SE	95% CI		t	df	p
				Lower	Upper			
BDpre_avg - BDpost_avg	1.84	0.96	0.23	1.36	2.31	8.13	17	0.00

An aggregated paired samples t-test was conducted to further explore the impact of mindfulness on physiological anxiety by comparing each pre and post biodot reading. Each of the paired samples t-tests resulted in a significant difference in scores between the pre and post-tests (see Table 4.9).

Table 4.9

Paired Samples T-Test for Each Biodot Reading Before and After Mindfulness

Pairing	M	SD	SE	95%CI		t	df	p-value	Adjusted*	Hedge's g
				Lower	Upper					
BD 1:1 - BD 1:2	2.46	1.37	0.36	1.68	3.25	6.75	13.00	0.00	0.00	2.08
BD 2:1 - BD 2:2	1.94	1.29	0.31	1.28	2.60	6.23	16.00	0.00	0.00	1.67
BD 3:1 - BD 3:2	1.83	1.51	0.39	1.00	2.67	4.71	14.00	0.00	0.00	1.27
BD 4:1 - BD 4:2	1.87	1.20	0.31	1.20	2.53	6.01	14.00	0.00	0.00	1.48
BD 5:1 - BD 5:2	2.32	1.30	0.35	1.57	3.07	6.71	13.00	0.00	0.00	1.58
BD 6:1 - BD 6:2	1.38	1.63	0.41	0.51	2.24	3.38	15.00	0.00	0.02	0.83

*Adjusted p-value for family-wise error rate.

A graph of the differences illustrates that there was an observable difference between the pre and post Biodot measurement score among the intervention group (see Figure 4.1).

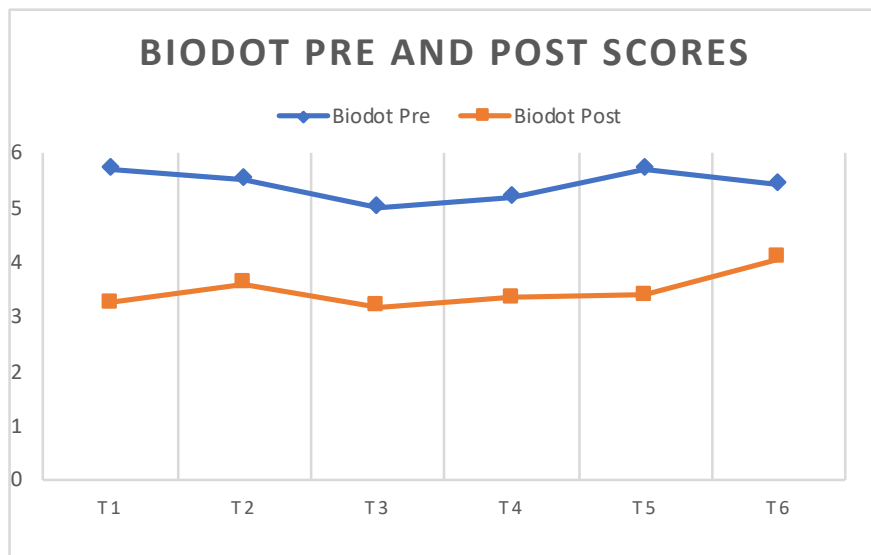


Figure 4.1 Difference Between the Pre and Post Biodot Measurements

A Bonferroni adjustment was used in the calculated p-values to account for family-wise error rates associated with repeated t-tests and to avoid the potential for a Type I error. The results (post FWER) indicate that the practice of mindfulness does have an effect on student anxiety levels as expressed through body temperature as illustrated in Figure 4.1. Five of the six

trials were significant at $p < .001$, and the sixth was significant at $p < .05$. I can reject the null hypothesis that there is no difference in Biodot measurement from pre and post mindfulness practice. Specifically, the results suggest that when high school students are exposed to 12 minutes of mindful meditation, their emotionality component of test anxiety decreases.

Results Summary

The original research questions were: does the practice of mindfulness based intervention in the form of guided practice reduce a student's test anxiety (worry and emotionality) and does this same practice improve a student's performance on the American College Testing test (ACT)? There were not significant effects between groups or within groups on the cognitive indicators (worry) including academic test measures or the TAI-G. There were significant decreases in the physiological indicators (emotionality) of anxiety in each session based on the biodot measurements. There was also a significant reduction in indicators over time when the outlier was removed. This indicates that the intervention was reducing the variation over time and in effect stabilizing anxiety levels similar to the practice of MBSR (Huppert & Johnson, 2010; Renshaw & Cook, 2017). Although we fail reject the null hypothesis that scores between the group practicing mindfulness and the control group were different at $\alpha < .05$ in all academic tests, we cannot say for certain that there would not be a difference with a larger group and higher power. There was, however, enough power to detect the differences within subjects concerning physiological response once the outlier was removed from the data. The repeated measures ANOVA showed a significant within subjects effect for the intervention group at $F = 3.12(4)$, $p = .03$, $\eta^2 = .24$. Although the initial test resulted in a failure to reject the null, it led to further investigation of the Biodot scores and the effect of mindfulness during the sessions. When treating the sessions as independent due to extraneous variables and sample attrition, not

only was there an overall effect at $t(17) = 8.13, p < .001, g = 1.90$, there was also a significant effect from pre to post mindfulness practice as measured by body temperature using the Biodot at $p < .001$, average $g = 1.61$ for 5 sessions and $p < .05, g = 0.83$ for the 6th session. This suggests that the mindfulness sessions did have a significant impact on the participants emotionality both on a regular day and immediately before taking the ACT.

Discussion

Introduction

The practice of mindfulness trains participants to be aware and attentive to the present moment (Kabat-Zinn, 1994). Teaching this practice to students has been shown to decrease anxiety, allow them to accept their personal experiences (Huppert & Johnson, 2010) and reduce negative affect while increasing a sense of calm (Broderick & Metz, 2009; von der Embse et al., 2013). The practice of mindfulness in schools is a more recent phenomenon, but recent studies have shown positive effects not only in anxiety levels, but also in academic achievement and cognitive functioning (Jha et al., 2007; Renshaw & Cook, 2017).

When students have high test anxiety, they do not perform as well on examinations (McDonald, 2001; Putwain, 2008; von der Embse et al., 2013) therefore, decreasing test anxiety could increase performance on tests (Chiesa et al., 2011). This study sought to determine if the practice of a mindfulness guided meditation based on MBCT (Baer, 2003) would significantly reduce student test anxiety and whether the practice of mindfulness would improve the ability to concentrate, set aside negative thoughts, and refocus thus increasing student performance on a standardized test.

High school students volunteered to participate in this research and were randomly placed into control and intervention (mindfulness) groups. Both groups took a pre ACT test at the start

of the research. The intervention group then participated in five weeks of mindfulness practice during or after school twice a week and just before the post-intervention ACT. After six weeks, all students took a post ACT test. Biodot measurements were also taken once a week before and after the sessions with the intervention group to determine the effect mindfulness practice had on anxiety levels. This research is unique to test anxiety research in that it utilized a brief mindfulness intervention which addressed both the worry and emotionality aspects of test anxiety and can be used in a classroom setting before an exam.

Synthesis of Findings

Using analysis of variance and paired samples t-tests, the data showed a significant decrease in emotionality (physiological) anxiety levels before and after mindfulness practice at $p < .01$, $\eta^2 = .24$, $g = 1.90$. The statistical power of the design was compromised by sample attrition and comparison of standardized test performance between the intervention and control groups or within the groups was not significant. Due to the significant impact of mindfulness in anxiety levels during individual sessions and the potential for significance over time, further research is recommended using a more controlled sample and administration environment as well as an extended intervention time.

Implications

Mindfulness is a beneficial practice in decreasing test anxiety in high school students. Interventions requiring 12 minutes twice a week resulted in significant reductions to variation in the physiological aspect of test anxiety. This is in concordance with Yeo et al. (2016) who found that brief interventions using meditation and coping strategies significantly lowered anxiety levels, however the greatest benefit was found in high anxiety students. This simple practice that can be done using a recording can significantly change a classroom environment (Huppert &

Johnson, 2010) and can be used in any setting. My study is similar to studies by Beauchemin et al. (2008) who found that a similar mindfulness meditation intervention decreased anxiety levels and Keng et al. (2011) who found that even brief mindfulness training can have an immediate positive effect as evidenced by the Biodot measurements in this study. If this study had been extended to twelve weeks, there may have been an even greater trend in decreasing anxiety over time (Zeidner, 1998). The pre-post differences confirm Vinkers et al. (2013) findings that the body temperature at the base of the thumb and forefinger decreases significantly when exposed to stress.

These findings support the mindfulness cognitive training theoretical framework on the emotionality side, however, the framework addressed both emotionality and worry. It suggested that by reducing a student's test anxiety through focused breathing (addressing emotionality) and cognitive restructuring of the thought process (addressing worry), a student would then perform better on a standardized test. This was based in part on the Cognitive Interference Theory (CIT) first introduced by Sarason (1984) with which this study does not align, however in several of these studies, students who had the greatest effect from CIT were those with high test anxiety. Because the sample was not broken into high and low anxiety groups, it is difficult to compare these studies (Cassady & Johnson, 2002; Culler & Holahan, 1980; Zeidner, 1998).

Although inconclusive in this research due to extraneous variables, mindfulness may decrease a student's test anxiety level over time as noted in Figure 4.3. With consistent dosing and controls over extraneous factors there is a potential for significant decrease in anxiety levels over time through the practice of a mindfulness based intervention as evidenced also by von der Embse et al. (2013), students exposed to relaxation methods reported lower stress levels. This information also lends itself to a decrease in general anxiety as Zeidner (1998) reported that

relaxation training directed toward modifying emotional reactions can also reduce anxiety in general, not just test anxiety.

Although there was not a significant impact on test scores, if there had been an adequate sample size and power, I would have been able to group students into anxiety levels as previous researchers had which would show more clearly the differences between high test anxiety and low test anxiety, the impact of mindfulness, and the possible impact on test scores as evidenced in prior research (Cassady & Johnson, 2002; Hembree, 1988; Sarason, and Stoops, 1978). My study is also discordant with Hembree (1988) who found that those with high test anxiety had lower test scores, however, the inability for my research data to point to an impact on test scores may also be in part due to Hembree's data which resulted in participants with lower test anxiety not having a significant change in test scores. Perhaps if my study were run with a larger sample size and then inviting only the top 25% and bottom 25% of anxiety level students to participate in the study, there would be results more in concordance with previous studies.

There was a quantifiable impact on anxiety level in the sixth session from entering the test site to beginning the test after the mindfulness intervention, however, it is inconclusive as to whether the intervention addressed both the emotionality and worry components effectively (Sapp, 2014) or whether the subjects with high test anxiety took longer to process, had difficulty with focus, or struggled to maintain accuracy as was found by Ikeda et al. (1996). Although GPA was collected as was done by Culler and Holahan (1980) who found that students with higher test anxiety had lower GPA's, my research not only did not group by anxiety level, but their GPA's and ability levels were homogenous and therefore a comparison would not result in statistical significance.

Limitations

This research study, while offering insight into mindfulness practice with students, had several limitations. Results from the traditional MBSR and from the adaptation MBCT programs have been significant in reducing anxiety in both clinical and non-clinical patients (Baer, 2003; Grossman et al., 2004; Keng et al., 2011), however, these programs do not work well in high schools due to scheduling and the need to take coursework specific to post-secondary goals and therefore needed to be adapted to fit a school schedule (Saltzman, 2014; Semple et al., 2017). This study focused only on particular aspects of mindfulness namely breath, thoughts, and acceptance as well as the cognitive behavioral aspect of picturing oneself taking an exam and working through the stress. Although effective at reducing the emotionality component of test anxiety, Kabat-Zinn (2003) makes it clear that the MBSR program is most effective as a holistic program. This requires a trained leader who not only practices mindfulness regularly, but also models it with the students. This was not possible with an audio recording only. Often MBSR for children and adolescents is about building relationships and allowing those in the group to build relationships with one another (Saltzman, 2014; Sowell, 2014), but eight minutes of rushing with 12 minutes of mindfulness did not allow for this either. After the first session, I immediately felt that it was not the mindfulness practice I was used to. As researcher, I chose to keep the sessions consistent across groups and maintained the recording only. Had it not been a recording, I would have been more intent about the conversation around the STAR method and ensured that student heard it and understood it (Saltzman, 2014; Tryon, 1980). Without the ability to model true mindfulness directly for the students, attempts at half-hearted mindfulness-based interventions run the risk of being a glorified relaxation strategy or exercise without any benefits of the true mindfulness experience. Kabat-Zinn (2003) states that "...unless the instructor's relationship to mindfulness is grounded in extensive personal practice, the teaching

and guidance one might bring to the clinical context will have little in the way of appropriate energy, authenticity, or ultimate relevance, and that deficit will soon be felt by program participants” (p. 150). In this study, a recording was used in order to allow multiple trainers to offer the same experience, and being that it is not true MBSR, it was not the focus on this intervention, however, the use of MBSR with a trained teacher might be ideal in a future study (Lawlor, 2014).

Mindfulness should not be taught with the intention of achieving a goal, and although the original plan was to look at mindfulness, when we chose to focus on dealing with test anxiety during the guided meditation, in hindsight, it became a goal thus losing the essence of mindfulness (Kabat-Zinn, 1994; Saltzman, 2014). Fjorback, Arendt, Ørnbøl, Fink, and Walach (2011) also noted that there is a risk to teachers delivering this training who have not been practicing for two or more years and could lead to poor outcomes. Levels of experience for the instructor might explain some of the variance between studies. “The popularity of mindfulness interventions involves the risk that the techniques may be misunderstood or inappropriately applied” (p. 117).

Limited data led to limited analysis. Measurements of test anxiety treatments were often based on a comparison between low and high anxiety groups (Hembree, 1988). A deeper look at the data collected in the research revealed that, when looking at quartiles based on the range of TAI-G scores possible, only one student in the treatment group fell into the high anxiety group. The majority of studies comparing high and low test anxiety groups divided students into the upper 25% and the lower 25% (Keogh & French, 2001). If the participants in this study were divided into these groups, there would have been only one person with high anxiety in the control and one in the treatment ($n = 2$ students in the upper 25%). In looking at the one student

in the treatment group with high anxiety, her anxiety level on the TAI-G dropped from the upper quartile at a 60 to the middle range at a 53 from pre to post test. For future studies, it would be important to be sure the students in the treatment group did have high anxiety as studies have shown that this is the group to have the greatest benefit and a performance increase on test scores (Cassady & Johnson, 2002; Chiesa et al., 2011; Hembree, 1988; Ikeda et al., 1996; Keogh & French, 2001). This study did have a control group, but there was no guarantee about anxiety levels of each and with a small sample size, I would not have had to power to run the study. Ensuring that there are enough students is important. This could be done through an in-school program which takes place during the school day (Saltzman, 2014; Semple et al., 2017). Due to the smaller numbers I also had to eliminate the comparison between male and female students, grade point average, along with anxiety levels as was used in previous research (Cassady & Johnson, 2002; Keogh & French, 2001; Zeidner, 1998). Limited data also led to inclusion of all data rather than only those who completed a specific number of sessions. If the data were run for those attending at least 75% of the sessions, there would have been only 12 participants in the treatment group, and there were no participants who attended every session.

Other limitations were due to changes in the original design. The intention was to offer mindfulness sessions during the school day for students already enrolled in a study hall type of class, however, there was no response from principals willing to allow research during this time. This made it a challenge to get students able to volunteer their time and the number of participants decreased to 40. I also had to utilize a group of volunteers from my own school with another teacher facilitating the session using the same recording. One school allowed me to come after school twice a week for the intervention group ($n = 15$ females) and one school with a time during the day ($n = 4$ males). This led to a less than ideal timing of the intervention and an

inability to create a calm space (Kabat-Zinn, 1994). Some of the students in the after school group had 20 minutes after school before the bus left to take them home. This did not leave students with much time to go to their locker, use the restroom, get checked in and settled, practice mindfulness in a guided session for 12 minutes, and then get their stuff together in order to get to the bus on time. These conditions are enough to induce anxiety (Keogh & French, 2001). Two of the ten sessions had a field trip return late causing students to run late both for the mindfulness session, and for the bus after. One session, the 5th, was the day before spring break and there was a good deal of yelling in the halls, extra announcements, slamming of lockers, excitement about leaving, and students late to the session and then worried about missing the bus. Given these issues, future research would benefit from taking place during the school day at a time dedicated to enrichment with mandatory attendance (Huppert & Johnson, 2010). There were also several extraneous variables that may have impacted the mindfulness sessions including announcements and noise in the hall, but according to field notes, these did not seem to affect the students participating (eyes remained closed, bodies remained still with the exception of the fifth session).

Another limitation was the fact that this was a known practice ACT (Keogh & French, 2001). Students typically pay to take the ACT and the scores are then sent to colleges and universities, I had to make it very clear that these scores could not be used for any purpose other than practice and exposure. “Without any fear of failure or encouragement to perform well on the test, a child is unlikely to put adequate effort into preparation or be sufficiently motivated when actually taking the test, and so will not perform to their fullest potential” (McDonald, 2001, p. 94). I attempted to account for this by creating a simulated testing environment and reiterated the high stakes associated with the test; however, several students were malcontent on the second

exam as evidenced by phrases written in the field journal including “I really don’t want to be here,” “This doesn’t even count for anything,” “My parents made me do this.”

This may have led to the low sample attrition rates and lack of in home guided practice (only one student reported practicing at home) thus, the overall effect of mindfulness may have been impacted (Parsons et al., 2017). In future research, there should be ample time to briefly explain mindfulness practice at every session for those who may have missed the first session or several sessions in between and an emphasis on practicing at home. However, due to a glitch in email rejection, students did not receive the guided practice until the second week of the intervention. And although reminding them weekly, a lack of home practice combined with the attrition rates was problematic in looking for an impact of MBCT in this study (Parsons et al., 2017). I attempted to keep students engaged by offering a drawing for gift cards at the end of the six weeks and adding their names for every session they attended. This could have been avoided if it was during the school day (Huppert & Johnson, 2010). Time of year may also have had an impact given that it is a busy time for high school students. Spring is already a packed time and trying to work around spring break and other activities was challenging. I had to offer two pre and two post-ACT test dates in order to accommodate schedules, school events, etc.

The Biodot was a consistent tool that was beneficial to measure within the sessions, but difficult between sessions due to the temperature fluctuations (Looker, 1985). The temperature for the first ACT was colder than 70 degrees, which may have had a negative effect on the Biodot reading, while the temperature for the second ACT control group was warmer than 75 degrees. Therefore, I cannot compare biodot reading from the Pre and Post ACT readings between groups (Biodot is best used with a room temperature between 70-75 degrees). Although thermostats were set for the first test, several students were putting on sweatshirts and

complaining of the cold. I couldn't schedule the second test in the same place due to timing. In this study I did not use a placebo, however, the biodot could be used to determine a placebo effect by having students in the control group come in and sit quietly without the mindfulness meditation and record their biodot color at the beginning and end of the session.

Future Research

Further research, perhaps over a longer period of time and utilizing a more robust and traditional version of MBSR may prove significant to test performance with the incorporation of mindfulness practice in schools by expanding the practice to a full semester (Fjorback et al., 2011; Saltzman, 2014) or keeping the guided meditation used, but adding a pre-session to explain the practice of mindfulness more clearly (Beauchemin et al., 2008). The current study provided insight into the immediate effect of a specific mindfulness practice of guided meditation, decreased anxiety based on an external body temperature measurement, but did not go beyond that. Perhaps using specific classes in a school and taking a measurement before every test in a particular class using a control and intervention group – one that is practicing mindfulness at the start of the day and one that is not would provide necessary empirically grounded significance (Brown, Ryan, & Creswell, 2007) without the stress of homework, exhaustion, athletics, buses to catch, and no time to practice at home.

TorchPrep has also started to implement mindfulness practices through guided meditation as a part of an ACT prep program. It would be great to see the combined effect of these as an MBCT intervention as study skills have shown to have an impact on test performance and anxiety when combined with relaxation techniques (Tryon, 1980).

To really assess how mindfulness affects test anxiety levels over time as well as the impact on standardized test scores, it would be important to have a larger number of participants,

smaller attrition rates, and an ACT that is an actual recorded test rather than a practice test (von der Embse et al., 2013). Keogh and French (2001) suggest that future studies should inform education policy makers about the impact of test anxiety and the importance of alleviating the negative effects it has on students' futures. Perhaps consideration of taking the timed portion of tests away entirely to allow for cognitive blocks to get worked through without running out of time (Zeidner, 1998). If there is a way to eliminate the negative self-talk and minimize distraction by increasing focus and positive reinforcement, then a student's performance would not be as impacted. Combining this cognitive intervention with the relaxation behavior interventions or mindfulness practice would minimize both the worry and emotionality components of test anxiety (Coy et al., 2011). If this study was to be repeated, it could be improved by taking place during school hours using the same guided meditation, but without a recording and beginning and ending with a short discussion around mindfulness – incorporated further aspects of MBSR (Tryon, 1980).

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Appendix A

Information Survey- no information will be shared in connection with your name. Your personal information will be kept confidential. You will be assigned a number randomly for data storage and the number will be attached to the information. Email will be used to send updates or changes to schedules in case of snow, etc.

Student First and Last Name

School

Student Email

Parent Email

1. What is your current letter grade in the following core subject:

Math _____

English _____

Social Studies _____

Science _____

2. How would you describe your course load (circle one)?

Regular level

Upper Level

Lower level

3. How much time do you currently spend weekly studying specifically for the ACT (circle one)?

None

1-2 hours

3-4 hours

5 or more

4. How many times do you currently practice mindful breathing or meditation weekly?

None

1-2 times

3-4 times

5 or more

Appendix B

Printed First and Last Name _____

Student Email _____

Test Anxiety Index-German: 17-Item (English Translation):

In the following inventory you will find statements that describe feelings and thoughts one might have when taking an exam. Please indicate how often you have such feelings and thoughts in exam situations in general.

	Almost Never	Sometimes	Often	Almost Always
1. I get "butterflies".	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. I have faith in my own performance.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. I am thinking about the consequences of failing.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. I ask myself whether my performance will be good enough.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. I am preoccupied by other thoughts which distract me.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. I feel uneasy.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. I know that I can rely on myself.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. I easily lose my train of thoughts.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. My heart pounds.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. I worry about my results.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. I feel anxious.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. I am satisfied with myself.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. My concentration is interrupted by interfering thoughts.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. I feel overwhelmed.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. I think that I will succeed.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. I think about what will happen if I don't do well.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. I am convinced that I will do well.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Biodot color (Circle when asked): **Black** **Brown** **Tan/Yellow** **Green** **Blue** **Purple**

Appendix C

Research REMIX Guided Meditation with REST, THOUGHTS, and STAR based on Guided Meditations provided by Dr. Amy Saltzman

For the next few minutes, I invite you to rest, rest in the still quiet place.

The still quiet place is always available inside you and you can find it just by following your breath.

Let's begin. Let your body rest sit in a comfortable position if you feel comfortable allow your eyes to close, if not focus your eyes on an easy spot about a foot in front of you.

Feel your body supported by the chair. If your arms or legs are crossed uncross them and find a position that lets you feel at ease and allow the muscles in your body and your face to soften maybe even let out a long slow sigh.

And now let your attention rest on the breath allowing the natural Rhythm of the breath. Breathing naturally feeling the belly expand with each in-breath and release with each out-breath.

Focusing your attention on the breath and allowing everything else to fade into the background. breathing in on 1 and resting, feeling the in-breath from the very beginning all the way through to where the breath is still just for a moment and the out-breath on 2 from the very beginning all the way through to where the breath is still again. 1, 2...

Now see if you can let your attention rest in the short, still, quiet place between the in-breath and the out-breath and rest again in the small still space between the out-breath and the in breath breathing and resting in the Stillness and quietness.

And when your attention wanders, which it will, *allow the thoughts to come in to your mind, name them, and then push them to the side as you* gently return it to the experience of breathing; feeling the natural Rhythm of the breath *and counting each inhale as 1, exhale as 2.*

Choosing to rest choosing to focus your attention on the breath allowing things to be just as they are allowing yourself to be just as you are nothing to change or fix or improve.

Inhale 1, Exhale 2....Breathing and resting resting and breathing.

Picture yourself taking an exam or working on a stressful project. As you begin to stress or worry,

Stop. When you realize you are having difficulty, stop or pause.

Take a Breath. After you have stopped or paused, take a long, slow, deep breath and maybe a few more.

Accept. Accept that you are having difficulties, accept that you don't know the answer, accept that you are a little stressed out. There is no need to fix or change anything. Continue Breathing.

Refocus. Whenever you are ready, simply begin again. Perhaps choosing a different problem, perhaps offering yourself a kind word or phrase such as "you got this". Perhaps remembering that you and your life are so much bigger than this particular test or challenge.

Take a few more deep breaths. Rest in stillness and quietness, and remember that you can use this simple practice of stopping, taking a breath, accepting, and refocusing for any test, project, or challenge.

Breathing and resting in the still quiet place are especially helpful when you are anxious, sad, nervous, bored, or angry so enjoy breathing and resting in the Stillness and Quietness